

STUDIES ON THE BRITISH DERMANYSSIDAE (ACARI : MESOSTIGMATA)

PART II. CLASSIFICATION

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SYNOPSIS

The classification of the Dermanyssidae s. lat. is discussed. The free-living, paraphagic, and facultative and obligatory ectoparasitic members of this family in the British fauna are distributed among eight subfamilies (Dermanyssinae, Haemogamasinae, Hirstionyssinae, Laelapinae, Macronyssinae, Melittiphinae, Myonyssinae and Pseudolaelapinae). Keys are given to subfamilies, genera and species. Eighty-one species and subspecies are described and figured.

INTRODUCTION

THE earliest suprageneric classification of the mites included in the present study may be attributed to Berlese (1892) who considered them to represent two families, the Dermanyssidae and the Laelapidae. The Dermanyssidae Kolenati, containing the obligatory ectoparasites, included the genera *Ophionyssus* Mégnin, *Leiognathus* Canestrini and *Dermanyssus* Dugès while the free-living forms, paraphages of arthropods and facultative ectoparasites, comprising the genera *Laelaps* Koch, *Hypoaspis* Can., *Seius* Koch, *Iphis* Koch, *Stylochirus* Can., *Neoberlesia* Berl., *Podocinum* Berl. and *Iphiopsis* Berl., were placed in the family Laelapidae Berlese. In his last comprehensive classification of the Mesostigmata published in *Acarotheca Italica* in 1913, Berlese retained his original concepts of the families although, by this

time, the large number of new genera added to the Laelapidae in the first decade of this century enabled him to attempt a tribal classification of this family. He proposed four tribes: Laelapini, Iphiopsini (based on Iphiopsidae Kramer), Eviphidini and Phytoseiini.

Subsequent classificatory works on these families have dealt almost exclusively with the "parasitic" forms and the most significant contributions during the thirty years following Berlese's classification are incorporated in the system presented by Vitzthum (1943). This author recognized a single family, Laelapidae, with thirteen subfamilies. The Dermanyssidae sensu Berlese was divided into two subfamilies, Dermanyssinae and Liponyssinae Ewing (= Macronyssidae Oudemans), and the Laelapidae into six subfamilies, namely, Laelapinae, Hypoaspidae Vitzthum, Hyletastinae Vitzthum (= Eviphidini Berl.), Iphiopsinae, Phytoseiinae and Raillietinae Vitzthum. Three of the remaining five subfamilies, Entonyssinae Ewing, Rhinonyssinae Trouessart and Halarachninae Oudms., contain respectively parasites of the respiratory tract of reptiles, birds and mammals which were included by Berlese (1913) in his family Pteroptidae (= Spinturnicidae Oudms.). Vitzthum further recognized the Haemogamasinae Oudms. and the Podocininae Berl. The subfamilial diagnoses are brief and generalized and, in certain subfamilies such as the Hypoaspidae and Podocininae, bear little relationship to their generic composition. Nevertheless, Vitzthum's classification provided an excellent summary of the existing knowledge of the group and a basis for subsequent revisionary studies.

Baker & Wharton (1952) modified Vitzthum's classification by distributing his thirteen subfamilies among nine families. Seven of the subfamilies were included in three families and each of the remainder was raised to family status as follows: Laelapidae (Laelapinae, Hypoaspidae and Hyletastinae), Dermanyssidae (Dermanyssinae and Liponyssinae), Phytoseiidae (Phytoseiinae and Podocininae), Iphiopsidae, Haemogamasidae, Raillietidae, Rhinonyssidae, Entonyssidae and Halarachnidae. No attempt was made to critically examine the classification at generic level.

Evans (1957), in the course of a revision of the British free-living and parasitic members of the Laelapidae sensu Vitzthum, adopted in a restricted sense Baker & Wharton's Phytoseiidae, raised the Eviphidini to family rank and combined the Laelapinae and Hypoaspidae within the subfamily Laelapinae. Numerous genera previously placed in the Laelapinae, Hypoaspidae and Podocininae were removed from the complex and distributed among the Aceosejidae and Neoparasitidae. Thus, with the earlier relegation of the Raillietinae into the synonymy (Evans, 1955) and the later elevation of the Podocininae to family status (Evans & Hyatt, 1958) Vitzthum's "Laelapidae" was restricted to the following eight subfamilies: Laelapinae, Iphiopsinae, Haemogamasinae, Dermanyssinae, Macronyssinae, Rhinonyssinae, Entonyssinae and Halarachninae. To these must be added Ixodorhynchinae Ewing (1923), Myonyssinae Bregetova (1956), Histrichonyssinae Keegan *et al.* (1960) and Allolaelapinae Tipton (1960).

This broad concept of the Laelapidae represents one of the two current approaches to the classification of the group. Its protagonists argue that it is premature to

attempt a familial classification of the complex when the morphology and biology of a large proportion of its members are so poorly known. Further, new subfamilial categories resulting from piecemeal revisions of the group can be more readily incorporated, provisionally, in a broad family unit than in a more rigid system, the alternative approach favoured by Baker & Wharton. In this latter system certain subfamilies of vertebrate parasites have been withdrawn from the family unit and given familial rank irrespective of their inter-relationships or their relationships with the free-living forms and invertebrate parasites remaining in the Laelapidae. The familial diagnoses are superficial and difficulties arise in the placing of new suprageneric taxa; for example, the Myonyssinae are included in the Laelapidae by Bregetova (1956) but in the Dermanyssidae by Strandtmann & Wharton (1958). This juggling with subfamilial and familial categories does little to solve the problem of a natural classification of the "Laelapidae". The basic requirement is a knowledge of the morphology and biology of the group at species level.

The present contribution is restricted to a study of the free-living, paraphagic, and facultative and obligatory ectoparasitic members of the group occurring in the British fauna. In adopting a broad family concept, we have used the oldest available family name, Dermanyssidae Kolenati, 1859. It should be pointed out that this family taxon and the Iphiopsidae Kramer, 1886, have priority over Laelapidae¹ Berlese, 1892.

CLASSIFICATION OF THE BRITISH DERMANYSSIDAE

The adoption of a parasitic mode of life by certain Dermanyssidae realised an evolutionary potential which has produced a vast assemblage of morphologically and biologically diverse forms. Most students of the group consider the parasitic forms to have evolved, in the first instance, from nest-inhabiting laelapines. The transition from a polyphagous free-living to a monophagous parasitic existence probably involved a non-specialized feeding phase that included occasional meals of tissue fluids exuding from skin abrasions of the "host". Such a generalized type of feeding has been retained by certain species of the genera *Androlaelaps*, *Laelaps* and *Haemogamasus*.

Evans (1955) suggested that the *Hypoaspis* complex may represent the "primitive" free-living group from which this transition was made. Its members show various degrees of association with other animals, either as nest inhabitants or paraphages, a wide range of feeding habits and an extensive geographical distribution. The least specialized members of this complex are probably the predatory forms inhabiting soil and humus, and on the basis of their morphology and ontogenetic development it is possible to define, at least for the purpose of discussion, a basic dermanyssid type with the following characteristics:

Adults: Chelicerae chelate-dentate; movable digit bidentate in the female, unidentate in the male; pilus dentilis short, setiform; dorsal seta and fissures present; spermadactyl free distally and grooved; arthrodial processes simple. Gnathosoma with three pairs of hypostomal and

¹ The genitive stem of *Laelaps* is "Laelap —" and in accordance with the International Code of Zoological Nomenclature (Articles 29a and 32a (iii)) the family and subfamily taxa become LAELAPIDAE and LAELAPINAE respectively (see Domrow, 1963).

one pair of capitular setae; deutosternum with six transverse rows of denticles; corniculi horn-like, parallel, grooved dorsally to accommodate salivary styli; pedipalps with five free segments and a two-tined apotele, chaetotaxy (2-5-6-14-15); tectum capituli with anterior margin denticulate.

Entire dorsal shield with 39 pairs of setae, of which 22 pairs (j_1 - j_6 , z_1 - z_6 , s_1 - s_6 , r_2 - r_5) occur in the podonotal region and 17 pairs (J_1 - J_5 , Z_1 - Z_5 , S_1 - S_5 and p_{x2} - p_{x3}) in the opisthonotal region, and 22 pairs of pores. Lateral unsclerotized integument with $r + R$ series of eight setae and UR series.

Tritosternum bipartite, base longer than wide, laciniae pilose. Sternal shield in female with three pairs of setae and two pairs of pores; metasternal setae free. Genital shield flask-shaped with one pair of setae. Anal shield with three setae, euanal setae absent. Opisthogastric cuticle with seven pairs of setae, metapodals small, subcircular. Peritrematal shields free posteriorly, peritreme extending beyond coxa I. Male with holovenral shield bearing ten pairs of setae excluding anals; genital orifice pre-sternal.

All legs six-segmented, excluding pretarsus, and with well developed retractile ambulacra; chaetotaxy as defined for normal condition by Evans & Till (1965), without marked sexual dimorphism.

Larva: Chelicerae chelate, weakly dentate; pilus dentilis simple, dorsal seta and fissures present. Gnathosoma with two pairs of hypostomal setae, capitular setae absent; deutosternum with weakly developed denticles; corniculi horn-like, weak; pedipalps with five free segments and a two-tined apotele, chaetotaxy (0-4-5-12-11); tectum simple.

Podonotal region with ten pairs of setae, nine pairs being situated on a weakly sclerotized podonotal shield; opisthonotum with seven pairs of setae, no pygidial shield.

Tritosternum bipartite, laciniae well developed. Sternal shield with three pairs of setae and two pairs of pores; metasternal and genital setae lacking. Anal shield with three setae, no euanal setae. Opisthogastric cuticle with four pairs of setae. Stigmata, peritremes and associated shields lacking.

Chaetotaxy of legs normal for this instar of the Gamasina (Evans & Till, 1965).

Protonymph: Chelicerae chelate-dentate, movable digit bidentate, pilus dentilis simple, dorsal seta and fissures present. Gnathosoma with three pairs of hypostomal setae, capitular setae present; deutosternum with six transverse rows of denticles, corniculi horn-like; pedipalpal chaetotaxy (1-4-5-12-15). Tectum with weakly denticulate anterior margin.

Podonotal region with 16 pairs of setae, 11 pairs being situated on the podonotal shield. Pygidial shield large, with eight pairs of setae, and the unsclerotized region of the opisthonotum with six pairs. Mesonotal scutellae present.

Tritosternum bipartite. Sternito-genital shield with three pairs of sternal setae and flanked by a pair of genital setae in the region of coxae IV; metasternal setae absent. Anal shield with three setae, euanal setae lacking; opisthogastric cuticle with four pairs of setae. Stigmata present, peritremes short, no peritrematal shield.

Chaetotaxy of legs as defined for free-living Dermanyssidae (Evans & Till, 1965).

Deutonymph: Gnathosoma with characteristics of the female. Dorsal sclerotization comprising single shield with lateral incisions indicating partial fusion of podonotal and opisthonotal elements. Chaetotaxy as in female.

Sternito-genital shield bearing three pairs of sternal setae and one pair of metasternals; genital setae flanking the shield in the region of coxae IV. Metapodal shields subcircular, small. Chaetotaxy of opisthogastric cuticle as in adult. Anal shield with normal three setae, euanals absent. Stigmata with well developed peritremes, peritrematal shields weakly developed. Chaetotaxy of legs as in adult.

Among the *Hypoaspis* complex certain members of the "genera" *Gacolaclaps* and *Hypoaspis* closely conform to our definition of the basic dermanyssid type, but the group as a whole shows considerable diversity in the external morphology of its

post-protonymphal developmental stages, particularly of the female. The general trends in the complex are towards increased sclerotization of the genital shield (*Pseudoparasitus*, *Ololaelaps*, *Laelaspis* and *Gymnolaelaps*), hypertrichy of the opisthotal and opisthogastric regions of the idiosoma of the deutonymph and adults, hypertrichy of tibia III and genu IV and modification of the chelicerae for specialized feeding. In older classifications of the "Laelapidae" considerable emphasis was placed on the size and chaetotaxy of the genital shield at generic and subfamilial levels, but with our knowledge of the morphology of a wider spectrum of the complex it is evident that this character shows considerable variation between congeneric species and does not warrant the taxonomic importance attributed to it by some authors (see Zumpt & Patterson, 1951). Hypertrichy of the idiosoma and legs commonly occurs in those forms showing some degree of association with other animals. It is first evident at the deutonymphal stage and on the dorsal shield is apparent only in the region of the *J* series. Considerable inter- and intrageneric variability is evident in the hypertrichy of the opisthogaster and in the marginal series of the setae (*R* and *UR*). This is very marked in the *Pneumolaelaps* group. Modifications of the chelicerae mainly affect the dentition and the size of the digits, the chelicerae retaining their basic chelate form. In the British representatives of this complex specialization of the chelicerae is found only in certain members of the myrmecophilous group *Laelaspis*. There is no evidence of any marked modification of the hypostome for specialized feeding in the complex and the degree of morphological diversity is of the same order as that found in other families which have radiated into a comparable variety of terrestrial habitats, for example, the Ascidae.

The *Laelaps* complex represents a group of the *Hypoaspis* stock which has evolved in close association with mammals, particularly rodents, and has retained to a remarkable degree the basic morphological features of its free-living, nest-inhabiting progenitors. Members of the genus *Androlaelaps* appear to be the least specialized group of the complex and have a wide geographical distribution in the nests of birds and mammals. Morphologically they can only be separated from species of the *Hypoaspis* complex (*Gaeolaelaps*) by the specialization of the digits and spermadactyl of the male chelicera and, to a lesser extent, by the tendency towards the enlargement of the pilus dentilis in the feeding stages. The functional significance of the non-chelate chelicerae of the males is not known, but this type of chelicera is by no means confined to the *Laelaps* complex. The chelicerae of the males of the myrmecophilous genera *Laelaspis* and *Laelaspulus* approach this condition and essentially similar chelicerae occur in such widely different ecological groups as *Julolaelaps*, associated with millipedes, and *Hemilaelaps*, ectoparasitic on reptiles. As in the *Hypoaspis* complex there is a trend towards increased sclerotization of the genital shield which may bear up to six pairs of opisthogastric setae and in the more specialized members of the complex, *Hyperlaelaps*, *Ondatralaelaps* and *Oryctolaelaps*, hypotrichy of certain palpal segments and of the dorsal shield is not uncommon. Hypertrophy of the leg setae occurs in many species of the complex and these stout, spine-like setae probably assist the movement of the mite through the fur of the host. The *Laelaps* complex appears to be basically polyphagous but with a tendency towards haematophagy in

the more specialized members. They are usually considered to be facultative ectoparasites. As the result of the unspecialized type of feeding the gnathosoma shows only minor modifications. Corniculi are present although sometimes reduced in size and degree of sclerotization; there are five to eight transverse rows of deutosternal denticles with a tendency towards a reduction in the number of denticles in each row; the labrum is well developed and usually broad and the weakly sclerotized tectum capituli has a smooth anterior margin.

The Haemogamasinae (*Haemogamasus*, *Eulaelaps* and *Brevisterna*) appear to represent another branch of the *Hypoaspis* stock which has evolved in close association with birds and mammals, but show a higher degree of morphological specialization than the *Laelaps* complex. A remarkable feature of the haemogamasines is the extensive hypertrichy of the idiosoma. This is not restricted to the opisthonotum and opisthogaster as in the majority of the *Hypoaspis-Laelaps* group, but extends into the podonotal region and, in some species, to the intercoxal region. Hypertrichy is first apparent at the protonymphal stage and may be restricted to the opisthosoma, as in *Eulaelaps*, or also affect the podonotum, as in *Haemogamasus*. The nature of the sclerotization of the idiosoma in the protonymph, deutonymph and adults of *Eulaelaps* and *Haemogamasus* conforms with the normal *Hypoaspis* type although there is increased sclerotization of the genital and metapodal shields in the female of *Eulaelaps*. In *Brevisterna* reduced sclerotization of the dorsum of the idiosoma is evident and the deutonymph and some adults have an abbreviated dorsal shield and a small discrete pygidial shield. The gnathosoma has been subjected to considerable specialization in the course of the adoption of haematophagy by some species. Invariably the number of transverse rows of deutosternal denticles shows an increase in comparison with the *Hypoaspis-Laelaps* complex and ranges between nine and 16 rows whilst the number of denticles in each transverse row tends to decrease to the extent that the denticles form a single longitudinal file in *Brevisterna*. Typical horn-like corniculi occur in the polyphagous species of *Eulaelaps* and *Haemogamasus* (e.g. *H. pontiger*), but there is a distinct trend towards their modification into membranous flaps in the obligate ectoparasites (*H. liponyssoides*, *H. hirsutus* and *Brevisterna*). The chelicerae also show considerable diversity in form. Unspecialized feeders retain the typical chelate-dentate form of the free-living *Hypoaspis* type, but in the blood-feeding deutonymphs and females of the group there is a tendency towards a reduction in the dentition of the digits and the enlargement of the pilus dentilis. In the males the chelate form of the chelicerae is retained and the relatively short spermatheca is never entirely fused with the movable digit. The anterior margin of the tectum may be fimbriated or smooth. The pedipalpal chaetotaxy is normal and the apotele is two- or three-tined. Deviations from the basic *Hypoaspis* type of leg chaetotaxy occur on genu IV and rarely on femora II and III.

Fain (1962), in his detailed study of the Ixodorhynchinae, has pointed out the close affinities of this subfamily with the Laelapinae (*Hypoaspis-Laelaps* group). Its members are ectoparasites of snakes and display some adaptive features which have not been observed in the Laelapinae and Haemogamasinae. The main evolutionary trends are towards decreased sclerotization of the dorsum and, to a lesser extent, the

sternal regions of the adults, hypotrichy of the idiosoma and appendages (legs and pedipalps), hypertrichy of the idiosoma, hypertrophy of the coxal setae and corniculi, and the reduction of the fixed digit of the chelicera. The sclerotization of the dorsum of the adults shows considerable diversity and may consist of an entire or laterally incised shield partially covering the idiosoma, or two distinct shields, a podonotal and opisthonotal, which allow greater flexibility of the idiosoma for movement under the scales of the host. Chaetotactic patterns of the idiosoma and segments of the appendages are extremely diverse even among congeneric species. Holotrichy of the dorsum of the idiosoma and of the opisthogaster is rarely, if ever, present, the primary chaetotaxy being reduced by the retardation in the development of certain setae during ontogeny or obscured by regional hypertrichy at the deutonymphal and adult stages. The segmental chaetotaxy of the legs and pedipalps also shows considerable deviation from the normal laelapine type and is apparent in the varying degrees of reduction in the segmental chaetotaxy of the femora, genua and tibiae. Hypertrophy of the postero-ventral setae of coxae I-III and more rarely the antero-ventral seta of coxa I occurs to a greater or lesser degree in all the genera. It is most marked in the genus *Asiatolaelaps* where the postero-ventral seta of coxa I is greatly enlarged and resembles the posterior retrose spur on coxa I in certain ixodid ticks. The corniculi are horn-like and subparallel or convergent in the genera *Hemilaelaps*, *Strandtibbettsia* and *Asiatolaelaps*, but in *Ixodorhynchus* and *Ixobioides* they are greatly enlarged and terminate in one or two retrose hooks which probably serve to anchor the mite to its host in a manner reminiscent of the Metastigmata. The hypostome invariably carries the normal three pairs of setae; the deutosternum is provided with five to seven transverse rows of denticles (each row comprising one to 20 denticles) and the tectum has a smooth anterior margin. The chelicerae are typically chelate-dentate in the females of *Hemilaelaps* and chelate-edentate in *Asiatolaelaps*. In both genera the pilus dentilis is conspicuous and has a tendency to be enlarged as in the *Laelaps* group. The chelicerae of the females of *Strandtibbettsia*, *Ixodorhynchus* and *Ixobioides* show a reduction in the size of the fixed digit. It is present as a remnant with a pilus dentilis in *Strandtibbettsia* but is completely lacking in the other two genera. According to Fain (loc. cit.) the chelicerae of the male resemble those of the *Laelaps* group. The nature of the sclerotization of the venter of the idiosoma is surprisingly constant throughout the subfamily; the sternal shield in the female usually has three pairs of setae and two pairs of pores; rarely it is reduced in size and carries only two pairs of setae; the genital shield is typically flask-shaped and bears the genital setae, and the anal shield is large. Stigmata and peritremes are present in both sexes and the peritrematal shield shows various degrees of development. The tritosternum is typically laelapine. The males have a narrow holo-ventral shield or separate sternito-genital and anal shields. The post-embryonic developmental stages comprise a larva, two active nymphal stages and the adult.

The subfamily Iphiopsinae contains paraphages and parasites of Arthropoda, particularly Insecta and Myriapoda. Little detailed information is available on the morphology and biology of this group and the subfamily at present functions as a depository for the more specialized forms which cannot be accommodated in the sub-

family Laelapinae. Our somewhat fragmentary knowledge of the species associated with Myriapoda and Formicidae (Insecta) suggests that the extent of adaptive radiation with its attendant morphological and biological specialization is considerable. The trends in morphological specialization parallel those in members of the family which have evolved in association with vertebrate hosts: reduction in idiosomal sclerotization (*Jacobsonia*, *Myrmoleichus*), hypertrichy of the idiosoma (*Dinogamasus*), hypotrichy of the idiosoma and the appendages, reduction of the fixed digit of the chelicera (*Berlesia*), elongation and fusion of the spermadactyl with the movable digit of the chelicera in the male (*Julolaelaps*), increase in number of transverse rows of deutosternal denticles (*Myrmonyssus*), reduction in the length of the peritreme and the enlargement of the stigmata (*Iphiopsis*), reduction of claws and the migration of the anus to a terminal position. The hypostome, on the other hand, does not appear to be affected to the same degree as in the vertebrate parasites.

The Myonyssinae probably represent an offshoot of the nest-inhabiting *Hypoaspis-Laelaps* group in which the main evolutionary trend has been towards the specialization of the gnathosoma. This is evident in the shape of the cheliceral shaft, the slender essentially edentate cheliceral digits, the reduction of the pilus dentilis and arthrodistal processes, the 9 to 12 rows of deutosternal denticles arranged in a single file and the elongate, distally tapering tectum. On the other hand, the corniculi remain horn-like although often weakly sclerotized. The chaetotaxy of the dorsum of the idiosoma and of the legs and pedipalps is typically laelapine. Varying degrees of hypertrichy of the opisthonotum are present and the genital shield may bear up to 22 setae. The anal shield is characteristically much broader than long. This subfamily contains only the genus *Myonyssus* whose members are facultative (? obligatory) parasites of mammals.

The subfamily Alphalaelapinae is based on the single species *Alphalaelaps saplodontiae* (Jellison, 1945), an ectoparasite of the primitive rodent *Aplodontia*. In general appearance the species resembles *Laelaps*, but presents a combination of specialized morphological features which precludes its classification in the Laelapinae. The gnathosoma shows considerable specialization: the deutosternal denticles (up to 14 in number) are arranged in a single file, the corniculi are semi-membranous, the tectum is membranous with a fimbriate anterior margin and the pedipalpal chaetotaxy is (2-4-6-14). Both digits of the chelicerae in the female are modified. The weakly sclerotized fixed digit is slender, tapering distally, and has a hyaline, retrose tooth, but apparently no pilus dentilis, while the movable digit is large, strongly sclerotized, hooked distally and unidentate. In the male the chelicera is of the non-chelate *Laelaps* type with the spermadactyl enormously elongated and about five to six times the length of the cheliceral shaft. The reduced fixed digit lacks a pilus dentilis. Arthrodistal processes and dorsal seta are absent. The chaetotaxy of the entire dorsal shield in both sexes is markedly hypotrichous, the podonotal region having 16 pairs of setae (21 present) and the opisthonotal region 10 pairs (*J*1-5 and *Z*1-5) of which *J*4 and *J*5 are reduced to microsetae. The ventral sclerotization of the female comprises a sternal shield with three pairs of setae and two pairs of pores (the metasternals being free), a large flask-shaped genito-ventral shield bearing six pairs of setae of which two

pairs are widely removed from the margins of the shield, and a normal anal shield. A sternito-genito-ventral and discrete anal shield are present in the male. Hypertrichy of the opisthogaster occurs in both sexes and the peritrematal shield is fused with the podal elements of coxa IV. All the legs are strong and terminate in well developed ambulacra. Certain coxal setae are stout and spine-like, and the anterior spine on coxa II is well developed. Coxae III and IV each have a posterior spine as in *Myonyssus*. The chaetotaxy of the leg segments is normal except for tibia II ($1-\frac{2}{1}$, $\frac{2}{1}-2$), genu III ($2-\frac{2}{1}$, $\frac{2}{0}-1$), tibia III ($1-\frac{1}{1}$, $\frac{2}{1}-1$), genu IV ($1-\frac{2}{1}$, $\frac{2}{0}-1$) and tibia IV ($1-\frac{1}{1}$, $\frac{2}{1}-1$). The deutonymph is an active feeding instar with the general characteristics of the female.

The Raillietinae, parasites of the auditory meatus of ungulates, display yet another grade of morphological specialization which is seen in the sclerotization and chaetotaxy of the idiosoma and in the form of the cheliceral digits. Dorsal sclerotization in both sexes is reduced and comprises a relatively small, entire shield reminiscent of the form in some macronyssines. Hypotrachy of the podonotal and opisthonotal regions is very marked in *R. auris* and *R. hopkinsi*, and results from the suppression of a number of setae which normally appear at the protonymphal and deutonymphal instars. The sternal shield in the female is not fused with the podal elements of coxae II and, in the male, the ventral sclerotization consists of a sternito-genital and a discrete anal shield. Both digits of the well sclerotized chelicera are edentate in the female, and the pilus dentilis and dorsal seta are reduced to microsetae or are absent. Well developed arthrodial processes are present at the base of the movable digit. In the male the fixed digit is reduced and the large spermadactyl is fused with the movable digit as in the *Laelaps* group. The hypostome and labrum also resemble those of the *Laelaps* group with the corniculi well sclerotized and blade-like. There are six to eight transverse rows of deutosternal denticles. The pedipalps show a deficiency in tibial chaetotaxy, this segment retaining the larval complement of 12 setae. Deviations from the normal chaetotaxy of the legs occur on femur I (only three ventral setae) and femur III (five setae). The immature stages of the raillietines are not known. Domrow (1961) has provisionally placed within the genus *Raillietia* a species of dermanyssid (*R. australis*) which inhabits the ears of the wombat, *Phascolomis mitchelli* (Owen). This species, of which only the female is known, differs from *auris* and *hopkinsi* in having little or no hypotrachy of the idiosoma and thus shows a closer relationship with the *Laelaps* group.

The subfamilies Dermanyssinae, Macronyssinae, Histrichonyssinae and Hirstionyssinae comprise forms which are obligatory, haematophagous ectoparasites of reptiles, birds and mammals. They exhibit, in varying degrees, the following trends in morphological specialization: reduction in idiosomal sclerotization, hypotrachy of the primary chaetotaxy of the dorsum of the idiosoma, hypertrichy of the lateral and marginal series of dorsal setae and of the opisthogaster, modification of the corniculi and chelicerae, reduction in the number of denticles in each transverse row of deutosternal teeth, enlargement of the antero-dorsal spine of coxa II and diversification of the segmental chaetotaxy of the appendages. These trends are also apparent in many of the other groups of parasitic Dermanyssidae (see above), but it is

amongst these subfamilies that we find the most morphologically and biologically specialized ectoparasites of vertebrates. Of the four subfamilies the Hirstionyssinae appear in many ways to be the least specialized. The edentate or weakly dentate form of the chelicerae, the modification of the corniculi into membranous flaps and the single file of deutosternal teeth are adaptive features of the gnathosoma which appear to accompany haematophagy. Some degree of hypotrichy of the dorsal chaetotaxy occurs in all members of the subfamily, but the segmental chaetotaxy of the legs is normal except for deficiencies in the chaetotaxy of tibiae III and IV in some genera. The most significant adaptive trend, however, is towards the development of spur-like structures on the coxae and, to a lesser extent, on the genu and tibia of the anterior pair of legs. These processes, which may be setigerous (hypertrophied setae) or non-setigerous (cuticular protuberances) in origin, undoubtedly assist the mite in its movements through the fur of the host. The life-cycle comprises a non-feeding larva, a (?) feeding protonymph and an active, feeding deutonymph and adult. The genus *Hirstionyssus* and its allies have previously been included in the Macronyssinae, but it is apparent that they represent a bio-morphological group which is quite distinct from the *Macronyssus* complex. Many of the similarities between the two groups in external morphology (gnathosomal features and hypotrichy of the primary setation of the dorsum) are probably the result of convergent or parallel evolution.

Morphological specialization is so advanced in the Dermanyssinae that the external morphology of its members shows little resemblance to that of the laelapine stock. The extreme attenuation of the second cheliceral segment and reduction in the size of the digits in the protonymph, deutonymph and adult female are unique, while the high degree of specialization of the hypostome, the grades of reduction in dorsal idiosomal sclerotization, the hypotrichy of the idiosoma and the diverse segmental chaetotactic patterns of the legs and palps provide little tangible evidence as to the origin of the group or to its relationship with other obligatory ectoparasitic dermanyssids. Within the subfamily the species infesting birds (*Dermanyssus*) display considerably greater morphological plasticity (both inter- and intraspecific), especially as regards chaetotaxy, than do those parasitizing mammals (*Liponyssoides*). The developmental cycle is normal in that it comprises an inactive, non-feeding larva without the cheliceral modifications of the subsequent nymphal stages, an active feeding deutonymph with the general characteristics of the female, and the adult. The protonymph is apparently a more active feeding stage than the equivalent instar in the free-living laelapines.

The Macronyssinae also represent an extremely specialized group of obligatory ectoparasites but, unlike the Dermanyssinae, certain of its members have retained many features of the *Laelaps* group (particularly of *Neolaelaps* and *Notolaelaps*). These features are apparent in *Bewsiella* and *Ichoronyssus*, both parasites of Chiroptera, and may be seen in the general form of the idiosoma and legs, dorsal and ventral sclerotization and slight hypotrichy of the dorsum of the idiosoma and appendages. The occurrence of the more "primitive" macronyssines on Chiroptera has led Radovsky (1964), in his comprehensive and stimulating study of the bat macro-

nyssines, to postulate that the subfamily " has evolved primarily on bats and secondarily to have transferred to other mammals, reptiles and birds ". This seems a logical hypothesis on the basis of the degree of morphological specialization exhibited by the mammal, bird and reptile forms. Certainly, as in the dermanyssines, the parasites of mammals appear to represent the least specialized members of this subfamily, while the forms associated with birds and with reptiles show considerably greater morphological plasticity. All macronyssines have a strongly modified hypostome with hyaline corniculi which, in the majority, form a pre-oral trough. The chelicerae of the protonymph and female are essentially edentate although there is a tendency for the digits of the bat parasites to have denticulate hyaline processes. Only rarely is the fixed digit reduced in the male which has a grooved spermadactyl incompletely fused with the movable digit. Reduction in dorsal idiosomal sclerotization is often marked in both protonymph and female and the dorsal chaetotaxy shows some degree of hypotrichy, the paravertical setae *z1* rarely being present. Many females and a few protonymphs and males have a conspicuous medio-ventral keel on the trochanter of the pedipalp, a structure which is not known to occur in the Dermanyssinae and is rarely present in the Haemogamasinae (some *Haemogamasus*) and Laelapinae (*Aetholaelaps*). The function of the keels is not known, but they may possibly protect and stabilize the somewhat elongated, membranous hypostome or, as Radovsky (1964) suggests, act as guides for the chelicerae. In addition to the adaptive features of the morphology, the macronyssines display one feature of their biology which is unique amongst the facultative and obligatory ectoparasitic Dermanyssidae, that is, the replacement of the normal, active, feeding deutonymph by a relatively inactive, non-feeding instar which shows considerable degeneration of the feeding organs, tritosternum, idiosomal sclerotization and ambulacra. The presence of this stage (a quasi-calyptostase) has not been established for the genera *Bewsiella* and *Ichoronyssus*. It seems probable that the Dermanyssinae and Macronyssinae represent two distinct bio-morphological groups which have probably evolved quite independently of each other from amongst the Laelapinae.

The Hystrichonyssinae, based on the genus *Hystrichonyssus* whose only known species is an ectoparasite of a Malayan porcupine (*Atherurus macrourus*) and an elephant tree snake (*Acrochordus javanicus*), present yet another combination of adaptive characters which includes modification of the hypostome for haematophagy, extreme elongation of the basal cheliceral segment, reduction in dorsal idiosomal sclerotization and marked hypotrichy of the primary chaetotaxy of the dorsum. Although the chelicerae superficially resemble those of the Dermanyssinae in their extreme length and needle-like proportions, they are the result of a different evolutionary trend, the second segment in *Hystrichonyssus* retaining the typical form of a macronyssine mite. Only the female is known.

The subfamilies Entonyssinae, Rhinonyssinae and Halarachninae contain the endoparasitic members of the Dermanyssidae s. lat. In general, morphological specialization in these groups is characterized by simplification in structure and this is to be seen in the form of the gnathosoma, in the progressive trend towards extreme

reduction in idiosomal sclerotization, in the reduction of the tritosternum and in the high degree of hypotrichy of the idiosoma and appendages due to both larval and post-larval specialization. This contrasts with the tendency towards the elaboration of certain structures in the facultative and obligatory parasites, for example, the complex specialization of the hypostome, the hypertrophy of setae to form attachment organs and the hypertrichy of the idiosoma. Each subfamily exhibits grades of morphological specialization and many of the similarities between them are probably the result of convergent or parallel evolution. The least specialized biologically and morphologically are the Entonyssinae which inhabit the respiratory tract of reptiles. They show comparatively little reduction in idiosomal sclerotization and chaetotaxy when compared with the dermanyssids (Ixodorhynchinae) ectoparasitic on reptiles and, in the female, the chelicerae are well developed, chelate-dentate (rarely edentate), and usually have a dorsal seta, arthrodial processes, fissures and a pilus dentilis while in the male the fixed digit is reduced and the long spermadactyl is almost entirely fused with the slender movable digit. All grades of reduction of the tritosternum are evident, from the large bipartite form in *Entonyssus* to its complete absence in *Hamertonia*. The hypostome is simple and weak corniculi may be present or absent. Fusion of the palptibia and tarsus to form a tibiotarsus and a reduction of the apotele occur in some forms. The segmental chaetotaxy of the appendages is diverse. Two active nymphal stages occur in the life-cycle, the deutonymph showing no degeneration of the feeding organs (Fain, 1961). Present morphological and biological evidence suggests that the Entonyssinae have probably evolved from amongst the Ixodorhynchinae. Fain (1961 and 1962) classifies the Ixodorhynchinae within the family Laelapidae but gives familial status to the Entonyssinae. In our opinion this exaggerates the difference between the two groups and has little practical value.

The Rhinonyssinae are parasites of the respiratory tract of birds and the degree of reduction in idiosomal sclerotization and hypotrichy of the idiosoma and appendages exceeds that in the Entonyssinae and in any of the groups of ectoparasitic dermanyssids. Reduction or loss of the tritosternum is a common feature of the group, the peritremes may be strongly reduced or lacking and the stigmata displaced to a dorso-lateral position. Modifications of the chelicerae affect the size of the digits, their dentition and shape of the shaft. The gnathosomal and pedipalpal chaetotaxy shows varying degrees of reduction but the hypostome is invariably simple with the corniculi reduced or absent. As in other endoparasitic dermanyssids, the sensory area on tarsus I is extensive with the eupathidia- or solenidia-like setae dispersed and not aggregated as in the free-living and ectoparasitic forms. The life-cycle of the rhinonyssines resembles that of the macronyssines in having an inactive deutonymph with non-functional trophic appendages. Many of the less specialized members of the subfamily, e.g. *Mesonyssoides*, show a striking morphological resemblance to the macronyssines and we are inclined to agree with Radovsky (1964) that the rhinonyssines have probably evolved from the Macronyssinae.

Endoparasites of the respiratory tract of mammals are included in the subfamily Halarachminae. The gnathosoma of the adults is relatively simple; the hypostome lacks corniculi, the deutosternal denticles are reduced, the pedipalps show a trend

towards fusion of the tibia and tarsus and, in *Pneumonyssus*, a marked reduction in the size of the segments, and the apotele may be present or absent. The chelicerae may be small with the digits edentate (*Pneumonyssus*) or strongly developed with the fixed digit reduced or absent in the female (*Halarachne*). Hypotrichy of the venter of the gnathosoma, pedipalps and idiosoma is often very marked. The dorsum is usually partially covered by an entire shield while the genital shield is reduced or absent. Many segments of the legs retain their larval complement of setae. All legs have ambulacra, normally with strong claws. Biologically this group differs from all other known Dermanyssidae in having an extremely active larva which probably functions as the dispersal stage, but no active feeding nymphal stages. The nymphal instar (or instars) described by Hull (1956) for *Pneumonyssus simicola* Banks appears to be non-feeding and of short duration. In *Pneumonyssus* the larval pedipalps show considerably less specialization than in the adult and the legs have long, slender pretarsi with unmodified pulvilli and claws.

Recently Domrow (1961) has described a nymphal (protonymph) dermanyssid from the nasal passages of a marsupial mouse (Dasyuridae) and two species of scale-tailed rats (Muridae). On "purely ecological grounds" this species was placed in the genus *Pneumonyssus* (*Pneumonyssus dentatus* Domrow). The protonymph presents a combination of laelapine and macronyssine characters and is certainly not congeneric with *Pneumonyssus*. In our opinion it should not be classified in the Halarachninae. Macronyssine features are seen in the nature of the sclerotization of the dorsum of the idiosoma which comprises a well defined podonotal shield with the normal eleven pairs of setae, mesonotal scutellae and a reduced pygidial shield bearing seven pairs of setae and similar in form to that of the protonymph of certain *Macronyssus*. The gnathosoma, on the other hand, exhibits certain features of the Laelapinae, horn-like corniculi and up to nine transverse rows of deutosternal denticles, each row being multidentate. The chelicerae are extremely specialized, the basal segment is strongly sclerotized and is about two-thirds the length of the second segment which terminates in a large, hook-like, fixed digit lacking a pilus dentilis while the shorter movable digit is slender and edentate. Hypertrophy of certain gnathosomal and leg setae is also a feature of the species. A decision on the systematic position of *P. dentatus* must await the discovery of the adult stages, but, in the meantime, the unique combination of morphological characters displayed by the protonymph requires recognition and we propose the genus *Domrownyssus* (type: *Pneumonyssus dentatus* Domrow, 1961) for its reception. Provisionally the genus may be placed in the Laelapinae.

The above general review of the characteristics of the major subfamilies of the Dermanyssidae illustrates the high degree of morphological and biological specialization which has accompanied the adoption of a parasitic mode of life by certain members of the family. Each subfamily appears to represent a distinct bio-morphological group and exhibits grades of morphological specialization. A classification of the family purely on the basis of the external morphology of its members is fraught with difficulties, the most significant being the difficulty of defining concise practical units. It is only those groups of obligate ectoparasites, for example the Dermanys-

sinae and Macronyssinae, in which the transition from polyphagy to monophagy (haematophagy) has been universally accomplished and the accompanying adaptations of the chelicerae, hypostome and life-cycle are more or less stabilized, that a group-diagnosis appears to be at all practicable. In the other groups, the members present grades of morphological specialization depending on the nature of their association with the host. This is clearly seen in the structure of the chelicerae and hypostome of the Haemogamasinae, and in the degree of development of fixation organs (retrograde spurs) in the Ixodorhynchinae. Invariably, the least specialized members of the group provide a link between its more specialized members and the generalized laelapine forms. In these circumstances biological criteria may prove to be of considerable value in defining functional suprageneric categories.

The free-living, paraphagic and ectoparasitic members of the Dermanyssidae represented in the British fauna appear to fall, with two exceptions, into six subfamilies or biomorphological groups, namely the Laelapinae, Haemogamasinae, Myonyssinae, Hirstionyssinae, Dermanyssinae and Macronyssinae. The two species which cannot be accommodated in these subfamilies, *Pseudolaelaps doderoi* Berlese and *Melittiphis alvearius* (Berlese), appear to have greater affinities with the Laelapinae than with any other subfamily. We have already referred to the systematic position of *P. doderoi* as being "problematical" (Evans & Till, 1965). This arises from two unusual features of the external morphology of the adults, the marked hypotrichy of the idiosoma and appendages and the trispinate tectum, which immediately distinguish them from any known free-living laelapine. *M. alvearius*, previously classified in the Eviphididae (see p. 273), also presents a combination of morphological characters (form and chaetotaxy of the dorsal shield, sclerotization of the presternal region, nature of the deutosternal denticles etc.) which precludes its classification in the Laelapinae. Provisionally, and as a practical expediency, we are proposing suprageneric categories for each of these species.

The following key to the subfamilies is based on the characteristics of the British species of free-living and ectoparasitic Dermanyssidae. A comprehensive diagnosis of these groups is given elsewhere in the text. It is rarely that any one "character" is sufficiently stable throughout a subfamily to be entirely diagnostic, therefore the separation of the groups has been based on combinations of characters.

KEY TO THE SUBFAMILIES OF THE BRITISH DERMANYSIDAE

- 1 Chelicerae in the nymphal stages and female with the second segment enormously elongated, stylet-like; digits minute. Males with fixed digit reduced and the elongate spermadactyl entirely fused with the movable digit; chelicerae never chelate. Tarsi III and IV of the male with seta pv_2 modified into a short, tooth-like projection. Both sexes with paravertic setae absent. Obligatory ectoparasites of birds. DERMANYSSINAE (p. 346)
- Second segment of the chelicerae in nymphal stages and female never conspicuously elongated, digits prominent. Seta pv_2 on the tarsi of the males never modified into a tooth-like projection. 2
- 2 Dorsal shield in deutonymphal and adult stages markedly hypertrichous, setation often resembling a pelage. Genital shield, and sometimes sternal and anal shields, with unpaired accessory setae. Deutosternum with 10 or more transverse rows of denticles, majority of rows compound. Tectum with margins conspicuously

- fimbriated. Pedipalpal chaetotaxy normal. Chelicerae normally chelate-dentate in both sexes, rarely edentate, but pilus dentilis prominent. Associated with birds and mammals as nest inhabitants or ectoparasites . HAEMOGAMASINAE (p. 238)
- Hypertrichy of the dorsal shield, when present, restricted to the region of the *J* series or, if more extensive, deutosternal denticles in a single file and no accessory setae on the genital shield 3
- 3 Genu and tibia I with two ventral setae ($2-\frac{3}{1}, \frac{3}{1}-2$), genu II with one ventral seta ($2-\frac{3}{1}, \frac{3}{1}-2$). Tectum trispinate. Marked hypotrachy of the dorsal shield, podonotal region with 15 pairs (paraverticals absent) and opisthonotal with nine pairs of setae. Podal-peritrematal shields in female greatly enlarged posterior to coxae IV and flanking the genito-ventral shield. Chelicerae in both sexes chelate-dentate. Free-living. PSEUDOLAEAPINAE (p. 265)
- Genu and tibia I normally with three ventral setae ($2-\frac{3}{1}, \frac{3}{1}-2$),² genu II with two ventral setae ($2-\frac{3}{1}, \frac{3}{1}-2$). Without the above combination of characters 4
- 4 Anal shield in the female considerably wider than long, anterior margin concave (Text-fig. 64B). Chelicerae essentially edentate, digits long and slender in both sexes, spermadactyl entirely fused with movable digit in the male; pilus dentilis, arthrodial processes and dorsal seta apparently absent. Deutosternum with 9-12 denticles arranged in a single file. Paravertical setae (*z*₁) present in both sexes. Genital shield in the female with unpaired accessory setae. Anterior spine of coxa II prominent. Associated with small mammals. MYONYSSINAE (p. 268)
- Without the above combination of characters 5
- 5 Corniculi horn-like, strongly or weakly sclerotized, never in the form of hyaline lobes. Chelicerae in the female usually chelate-dentate, rarely edentate but pilus dentilis present. Chelicerae of the male chelate-dentate with free spermadactyl, or with reduced fixed digit and elongate spermadactyl partially or completely fused with movable digit, non-chelate. Dorsal chaetotaxy holotrichous or hypertrichous, if hypotrichous, paravertical setae present or chelicerae in both sexes chelate-dentate (*Oloaelaps sellnicki*). Free-living, nest inhabitants and facultative (? obligatory) ectoparasites of vertebrates 6
- Corniculi never horn-like, usually in the form of hyaline lobes. Chelicera in the female with digits essentially edentate, often with smooth or denticulate hyaline lobes, pilus dentilis absent. Chelicerae of the male edentate, digits subequal, fixed digits never markedly reduced in length, spermadactyl free distally, rarely approaching the length of the second cheliceral segment. Primary dorsal chaetotaxy invariably hypotrichous, paravertical setae absent. Obligatory ectoparasites of vertebrates. 7
- 6 Presternal area in the female with a keel-like ridge. Deutosternum in both sexes with about eight denticles arranged in a single file. Cheliceral digits in the female chelate, weakly dentate, pilus dentilis prominent, in the male non-chelate, fixed digit reduced, elongate spermadactyl completely fused with movable digit. Dorsal shield with general hypertrichy. Anal shield (female) or ventro-anal shield (male) with posteriorly directed spur anterior to the anus. Male with sternito-genital and ventro-anal shields. In bee-hives MELITTIPHINAE (p. 273)
- Presternal area in the female reticulated or with pre-endopodal shields, never with a keel-like ridge. Deutosternum with five to seven (usually six) transverse rows of denticles, rows usually compound, sometimes reduced to a single denticle. Chelicerae in the female chelate-dentate or, rarely, chelate-edentate, pilus dentilis present, in the male chelate-dentate with spermadactyl free anteriorly or non-chelate with edentate fixed digit reduced and spermadactyl entirely or partially

² *Ornithonyssus sylviarum* is exceptional in having only two ventral setae on tibia and genu I in some specimens, but the chaetotaxy of genu II is normal ($2-\frac{3}{1}, \frac{3}{1}-2$).

- fused with the movable digit. Hypertrichy of the dorsal shield, when present, usually restricted to the region of the *J* series of setae. Anal shield never with posteriorly directed spur. Male with holovenral shield or with discrete sternito-genito ventral and anal shields LAELAPINAE (p. 124)
- 7 Both sexes with one or more of the coxae with retrograde non-setigerous spurs, excluding the anterior spine of coxa II; genu IV with one ventral seta. Palptrochanter without medio-ventral keel. Dorsal shield entire in both sexes. Deutonymph active, feeding, and resembling the female in the structure of the gnathosoma and its well developed, bipartite tritosternum HIRSTIONYSSINAE (p. 276)
- Both sexes without retrograde non-setigerous spurs on the coxae (excluding anterior spine on coxa II), at the most with weak ridges; genu IV with two ventral setae. Dorsal shield entire in the male but with entire, two subequal shields or with discrete podonotal, mesonotal and pygidial elements in the female. Palptrochanter usually with a medio-ventral keel in the female (weakly developed in *Ophionyssus* and some *Ornithonyssus*). Deutonymph inactive, non-feeding, with degenerate (larviform) chelicerae and a simple tritosternum bipartite only at the tip MACRONYSSINAE (p. 300)

The measurements given in the descriptions of species apply, in most cases, to a single specimen; no attempt has been made to assess intraspecific variation. They have been taken as follows, unless otherwise stated in the text:

Chelicera: segment I, maximum length; segment II, from base of segment to apex of fixed digit; movable digit, maximum length; spermadactyl, from base of movable digit to tip of spermadactyl.

Dorsal (or podonotal) shield: length in midline; width at level of seta *z6*.

Opisthonotal shield: width at level of seta *J1*.

Pygidial shield: width at level of antero-lateral corners.

Tritosternum: base, to point of division into two laciniae; laciniae, from point of division to tip.

Sternal shield: length in midline; width at level of second pair of sternal setae (*st2*).

Genital (or genito-ventral) shield: length from level of genital setae to posterior margin; width at level of genital setae (*gen.*).

Anal shield: length in midline to base of postanal seta; width through middle of anus.

Holovenral shield: length in midline from anterior margin of genital orifice to base of postanal setae; width at level of second pair of sternal setae (*st2*).

Distances between setae (*st1*, *st3*, *c.s.*, *hyp. 2*, *Jv2*): from centre of setal bases.

Segments of appendages (legs and pedipalps): median dorsal length; width at base of segment.

Subfamily LAELAPINAE Berlese

Laelaptidae Berlese, 1892, *Acari*, *Myr. Scorp.*, *Ital.* Ordo Mesostigmata: 30.

Adults: Chelicerae chelate-dentate in the female, movable digit bidentate; digits rarely edentate. Male chelicera chelate-dentate with spermadactyl long, grooved and free distally or non-chelate with spermadactyl partially or entirely fused with the

movable digit ; digits subequal in length or fixed digit markedly reduced, edentate. Pilus dentilis present, setiform or inflated ; dorsal seta, fissures and arthrodial processes usually well developed. Chaetotaxy of venter of gnathosoma normal. Pedipalps with five free segments, apotele two- or three-tined, chaetotaxy of trochanter to tibia (2-5-6-14), rarely femur, genu or tibia unidifferent (2-5-5-14 ; 2-4/5-6 13/14). Palptrochanter rarely with a medio-ventral spur-like ridge. Deutosternum with five to seven, usually six, transverse rows of denticles ; transverse rows sometimes reduced to a single denticle. Corniculi essentially horn-like, rarely with a hyaline expansion. Internal malae simple or branched, margin smooth or fringed. Tectum capituli well sclerotized with anterior margin denticulate, or membranous with smooth anterior margin.

Dorsal sclerotization in both sexes comprising an entire dorsal shield, rarely retaining the deutonymphal incisions. Primary chaetotaxy of dorsal shield comprising 39 pairs of setae of which 22 pairs occur in the podonotal region and 17 pairs in the opisthonotal. Variants are due to addition of one pair of posterior accessories ($px1$), or a pair of anterior accessories (ax), or to suppression of posterior accessories (px series), $j3$, $z3$, $J3$, $J4$ and $Z3$ and rarely $z1$. Hypertrichy of the shield usually restricted to the region of the J series, rarely affecting the entire shield. Marginal series showing considerable diversity in the number of setae. Dorsal setae simple, pilose, subspinose, clavate or cuneiform.

Tritosternum bipartite, laciniae well developed, smooth or pilose. Pre-endopodal shields present or absent. Sternal shield in the female with three, rarely four, pairs of setae and two or three pairs of pores. Metasternal setae, when free, situated on unsclerotized cuticle or on platelets. Genital shield narrow or variously inflated and bearing the genital setae and, in some forms, up to five pairs of opisthogastric setae. Anal shield free or fused with the genito-ventral shield to form a genito-ventro-anal shield (*Ololaelaps*) ; with the normal three setae, no euanal setae ; aciculated area conspicuous. Opisthogastric cuticle with varying grades of hypertrichy. Metapodal shields usually small, rarely fused with the genito-ventral shield. Peritrematal shields usually free posteriorly, but may be fused with the podal elements behind coxae IV. Podal shields poorly or well developed. Stigmata with well developed peritremes usually extending up to or beyond coxa I. Male with holoventral shield, rarely with sternito-genito-ventral and anal shields. Genital orifice presternal.

All legs six-segmented with ambulacra ; claws sometimes reduced or absent. Variants from normal segmental chaetotactic patterns may occur on tibia I ($2-\frac{3}{2}$, $\frac{3}{2}-2$), genu III ($2-\frac{2}{1}$, $\frac{2}{1}-2$; $2-\frac{2}{1}$, $\frac{2}{0}-1$), tibia III ($2-\frac{1}{1}$, $\frac{2}{1}-2$; $1-\frac{1}{1}$, $\frac{2}{1}-1$) and genu IV ($2-\frac{2}{1}$, $\frac{3}{0}-2$; $2-\frac{2}{1}$, $\frac{3}{1}-2$; $1-\frac{2}{1}$, $\frac{3}{0}-1$). Anterior spine on coxa II prominent, small, or absent. Seta av_1 on femur II may be modified to form a stout spine or spur in both sexes or in the male only.

Larva : Relatively inactive, non-feeding instar. Chelicerae small, chelate, dentate or edentate ; dorsal setae and fissures present ; pilus dentilis present but often reduced ; arthrodial processes weakly developed or absent. Hypostome with two pairs of setae ; corniculi small, horn-like ; internal malae simple. Deutosternum with five to seven transverse rows of denticles. Pedipalps with five free segments,

apotele two- or three-tined, chaetotaxy (0-4-5-12). Dorsal sclerotization weak or absent, podonotal region with ten, rarely nine, pairs of setae. Chaetotaxy of opisthonotum variable. Tritosternum bipartite, laciniae usually smooth. Sternal region with three pairs of setae; opisthogaster with four pairs, excluding the three setae associated with the anus. Stigmata and peritremes absent. Segmental chaetotaxy of the legs normal for this instar.

Protonymph: Active (?) feeding stage. Gnathosoma, excluding pedipalps, similar to that of the female but not so well developed. Pedipalps with normal chaetotaxy (1-4-5-12).

Dorsal sclerotization comprising well developed podonotal, mesonotal and pygidial elements. Holotrichous condition of the dorsum consisting of 30 pairs of setae; podonotal shield usually with 10 or 11 pairs, pygidial shield with eight pairs. Tritosternum as in adult. Sternal shield with three pairs of setae and two pairs of pores; genital setae free on integument. Anal shield normal. Opisthogastric cuticle with four pairs of setae. Stigmata and short peritremes present. Chaetotaxy of legs normal for this instar.

Deutonymph: Active feeding stage. Gnathosoma as in female. Dorsum with a single, incised, rarely entire, dorsal shield. Dorsal chaetotaxy as in adult. Sexual dimorphism affecting marginal series in some forms. Tritosternum as in adult, sternito-genital shield with four pairs of setae (metasternals present) and three pairs of pores; genital setae free on integument. Anal shield normal. Opisthogastric cuticle with seven pairs of setae or displaying hypertrichy. Peritremes as in adult, peritrematal shield always free posteriorly. Metapodal shields present. Segmental chaetotaxy of legs as in corresponding adult.

KEY TO THE GENERA OF THE BRITISH LAELAPINAE

- 1 Female with anal shield completely fused with genito-ventral shield. Metasternal setae situated on sternal shield. Dorsal shield arched, completely covering dorsum of mite. Apotele with three unequal prongs **LOLOLAELAPS** (p. 228)
- Female with anal shield free. Metasternal setae not on sternal shield 2
- 2 Genu IV with two postero-lateral setae, pl_2 present ($2-\frac{2}{2}$, $\frac{3}{3}-2$). Pilus dentilis long, slender or inflated. Chelicerae of male strongly modified, never chelate 3
- Genu IV with one postero-lateral seta ($2-\frac{2}{2}$, $\frac{3}{3}-1$) or, if two postero-lateral setae present, pilus dentilis short, setiform. Chelicerae of male chelate-dentate 6
- 3 Female with genital shield bearing the genital setae only **ANDROLAELAPS** (p. 150)
- Female with genito-ventral shield bearing three pairs of opisthogastric setae in addition to the genitals. 4
- 4 Medio-dorsal series of setae hypotrichous, j_3 , J_3 , J_4 lacking. Femur I with seta pd_1 arising from a strong, sclerotized protuberance. Associated with *Ondatra*, introduced **ONDATRALAELAPS** (p. 145)
- Medio-dorsal series of setae normal, comprising 11 pairs of setae (j_1-j_6 ; J_1-J_5). Seta pd_1 on femur I not arising from a strong protuberance 5
- 5 Genu III with nine setae. Dorsal setae rarely short, subspinose; px_2 and px_3 present. Male with holovenral shield **LAELAPS** (p. 127)
- Genu III with eight setae. Dorsal setae short, subspinose, never more than one pair of px setae. Male with sternito-genito-ventral and anal shields **HYPERLAELAPS** (p. 140)

- 6 Female with large genito-ventral shield bearing four or more pairs of setae of which two pairs are widely removed from its lateral margins. Pedipalpal apotele three-tined, posterior tine small **PSEUDOPARASITUS** (p. 224)
- Female with genital shield bearing genital setae only or, if with genito-ventral shield, the additional setae are situated on its lateral margins. Pedipalpal apotele normally two-tined, rarely with three subequal tines **HYPOASPIS** s. lat. (p. 158)

Genus **LAELAPS** Koch

Laelaps Koch, 1836, *Deutschl. C.M.A.* **4** : 19 ; Koch 1843, *Arachnidensystems* **3** : 88.

Echinolaelaps Ewing, 1929, *Manual of External Parasites* : 10 and 185.

Macrolaelaps Ewing, 1929, *Manual of External Parasites* : 185.

Myolaelaps Lange, 1955, *Opred. Faune SSSR.* **59** : 328.

Rattilaelaps Lange, 1955, *Opred. Faune SSSR.* **59** : 328.

Microtilaelaps Lange, 1955, *Opred. Faune SSSR.* **59** : 329.

Type : *Laelaps hilaris* Koch, 1836.

Medium sclerotized mites ranging from 500 μ to 1,500 μ in length. Chelicerae chelate-dentate in the female with the movable digit bidentate. Fixed digit in the male markedly reduced, normally edentate ; movable digit edentate and partially or entirely fused with the elongated, grooved spermadactyl. Pilus dentilis in both sexes normally large and inflated distally. Dorsal seta and fissures normal. Arthrodial processes present at base of movable digit. Chaetotaxy of venter of gnathosoma and pedipalps normal, apotele two-tined. Deutosternum normally with six, rarely seven, rows of denticles, each row with one to three denticles. Corniculi horn-like, weak to medium sclerotization. Internal malae simple or fringed. Labrum broad, striated. Tectum capituli membranous, rounded anteriorly, never denticulate.

Dorsum of idiosoma with entire shield bearing 39 pairs of setae ; no unpaired accessory setae.

Tritosternum normal, bipartite. No definite pre-endopodal shields. Sternal shield in the female with three pairs of setae and two pairs of pores. Genito-ventral shield variously inflated and bearing four pairs of setae. Pear-shaped anal shield with normal chaetotaxy, paranal setae in line with posterior margin of anus or posterior to it. Opisthogastric cuticle with variable number of setae and affected by sexual dimorphism which is first apparent at the deutonymphal stage. Peritrematal shields free posteriorly, often weakly developed. Metapodal shields present. Male with holovenral shield not fused with peritrematal shields and bearing nine or ten pairs of setae excluding the anals. Podal shields poorly developed posterior to coxae IV.

Chaetotaxy of legs normal except for genu IV which has two postero-laterals ($2-\frac{2}{1}$, $\frac{3}{0}-2$) and sometimes two ventrals ($2-\frac{2}{1}$, $\frac{3}{1}-2$). Setae ad_1 and pd_1 on femur I and less conspicuously on femur II enlarged and elongated. Coxal setae often thickened to form stout spine-like structures. Coxa II with anterior spine. Ambulacra of legs II-IV with paired claws. Claws of leg I often reduced.

KEY TO FEMALES

- 1 Genu IV with two ventral setae (pv present) ; paranal setae short, their length equal approximately to width of anus (Text-fig. 1B) **L. agilis** Koch (p. 132)

- Genu IV with one ventral seta (*pv* absent) ; paranal setae relatively long, their length at least twice the width of the anus 2
- 2 Genito-ventral shield greatly expanded behind coxae IV, with posterior margin deeply concave ; distance between genital setae (*gen.*) less than that between *juv*₂. Dorsal setae relatively long ; length of *j*₅ distinctly greater than distance between *j*₅ and *s*₅ (Text-fig. 3A). Pilus dentilis setiform *L. echidnina* Berlese (p. 134)
- Genito-ventral shield only moderately expanded behind coxae IV, posterior margin rounded or very slightly concave ; distance between genital setae (*gen.*) greater than distance between *juv*₂. Dorsal setae relatively short ; length of *j*₅ distinctly less than distance between *j*₅ and *s*₅. Pilus dentilis inflated 3
- 3 Sternal setae relatively long and slender, *st*₁ reaching posterior margin of sternal shield. Dorsal setae slender ; marginal opisthogastric setae with bifid tips *L. hilaris* Koch³ (p. 128)
- Sternal setae short and stout, *st*₁ reaching base of *st*₂. Dorsal setae stout and spine-like ; marginal opisthogastric setae simple *L. muris* (Ljungh) (p. 137)

KEY TO MALES

- 1 Genu IV with two ventral setae (*pv* present) ; tarsus IV with setae *ad*₂ and *ad*₃ very long, thick, sword-like, their length at least twice the basal width of the tarsus (Text-fig. 2c). Peritremes relatively short, extending to posterior margin of coxae II. Paranal setae short, their length approximately equal to width of anus. Chelicera as in Text-fig. 2E *L. agilis* Koch (p. 132)
- Genu IV with one ventral seta (*pv* absent) ; tarsus IV with setae *ad*₂ and *ad*₃ setiform or blade-like but not exceeding 1½ times the width of the tarsus. Peritremes longer, extending at least to anterior margin of coxa II. Paranal setae longer, their length at least 1½ times the width of the anus 2
- 2 Holovenral shield with five pairs of stout setae in genito-ventral region (Text-fig. 5D). Tarsus IV with setae *ad*₂ and *ad*₃ blade-like ; seta *pv*₂ short, stout and spine-like (Text-fig. 5F). Chelicera as in Text-fig. 5B *L. muris* (Ljungh) (p. 139)
- Holovenral shield with six pairs of relatively slender setae in the genito-ventral region. Tarsus IV with setae *ad*₂, *ad*₃ and *pv*₂ normal 3
- 3 Coxa III with posterior seta stout, spine-like ; tarsus IV with setae *al*₁ and *pv*₁ stout and spine-like. Pilus dentilis inflated near its distal end ; chelicera as in Text-fig. 2B *L. hilaris* Koch³ (p. 130)
- Coxa III with posterior seta normal ; tarsus IV with setae *al*₁ and *pv*₁ slender, pointed. Pilus dentilis setiform ; chelicera as in Text-fig. 3E *L. echidnina* Berlese (p. 136)

Laelaps hilaris Koch

Laelaps hilaris Koch, 1836, *Deutschl. C.M.A.* 4: 20. Tipton, 1960, *Univ. Calif. Publ. Ent.* 16: 271, figs.

Female : Chelicera with segment I, 54 μ ; II, 110 μ ; movable digit 33 μ , bidentate ; fixed digit unidentate ; pilus dentilis elongate with swollen tip. Four pairs of gnathosomal setae with c.s. about 60 μ apart ; *hyp*. 2 about 54 μ apart. Deutosternum with six transverse rows of denticles (1-2 per row) ; corniculi 27 μ long ; internal

³ *Laelaps clethrionomydis* Lange (see Bregetova, 1956) commonly occurs on the bank vole, *Clethrionomys glareolus* [Schreber] in Europe and may possibly parasitize this host in Britain. It is closely related to *L. hilaris* but may be distinguished from it by the larger number of shorter, more spinose setae of the opisthogastric of the female and by tarsus IV of the male having seta *pv*₂ short and spine-like and setae *ad*₂ and *ad*₃ long and blade-like. These tarsal setae are simple, setiform in the male of *L. hilaris*.

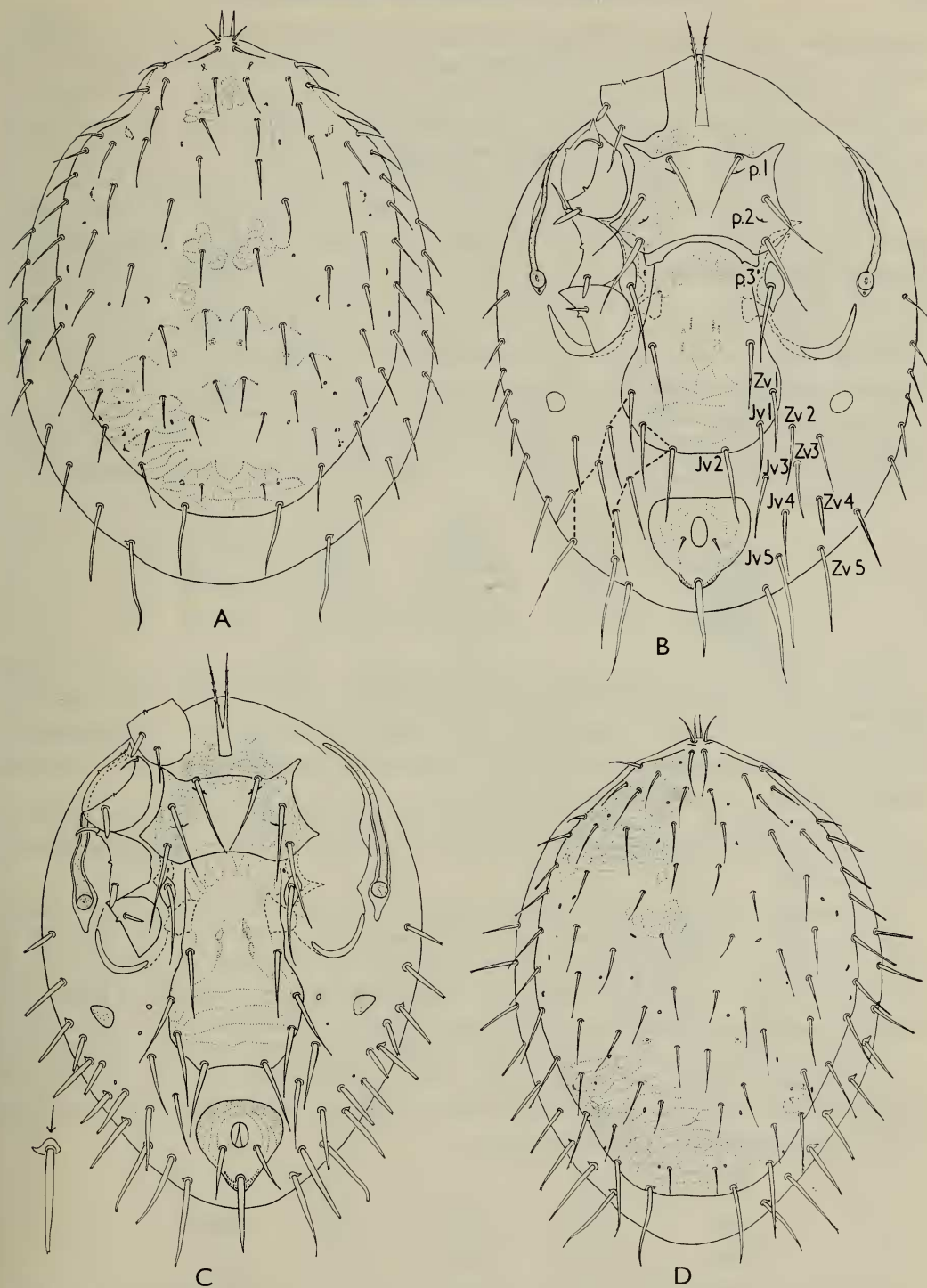


FIG. 1. A-B. *Laelaps agilis* Koch, female; dorsum (A) and venter (B) of idiosoma. C-D. *Laelaps hilaris* Koch, female; venter (C) and dorsum (D) of idiosoma.

malae with inner processes fringed, outer smooth (Text-fig. 2F). Tectum capituli with smooth anterior margin. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield ($636\ \mu \times 456\ \mu$) with 39 pairs of setae arranged as in Text-fig. 1D; marginal setae longer than the others, especially in the opisthonotal region, and most of them are barbed. Surface of shield reticulated; no hypertrichy; two pairs of *r* and seven pairs of *R* setae on the cuticle, all with bifurcate tips or small barbs.

Tritosternum with base $45\ \mu$, laciniae $102\ \mu$. Sternal shield ($102\ \mu \times 186\ \mu$) with three pairs of setae and two pairs of pores; metasternal setae on small platelets, their associated pores on the cuticle. Between *st*1, $80\ \mu$; between *st*1 and *st*3, $100\ \mu$. Genital shield ($144\ \mu \times 135\ \mu$) flask-shaped, with four pairs of setae. Between *gen.*, $114\ \mu$; between *Jv*2, $80\ \mu$. Anal shield ($105\ \mu \times 114\ \mu$), paranal setae $66\ \mu$, postanal seta $96\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 1C. Peritreme extends to posterior margin of coxa I; peritrematal shield free.

Chaetotaxy of legs differs from normal pattern in having two postero-lateral setae on genu IV. On tarsi II and III, setae *al*₁, *pl*₁ and *av*₁ are relatively stout, seta *pv*₁ is slender. Coxal setae as in Text-fig. 1C. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	66/57	72/60	50/45	80/48
tibia	70/40	57/57	48/45	78/48
tarsus	100/36	90/38	105/36	150/40

Male: Chelicera with segment I, $48\ \mu$; II, $105\ \mu$; movable digit $50\ \mu$ ($70\ \mu$ with spermadactyl); both digits edentate; pilus dentilis as in female. Four pairs of gnathosomal setae with c.s. about $48\ \mu$ apart; *hyp.*2 about $40\ \mu$ part. Deutosternum with six transverse rows of denticles (1-3 per row); corniculi $33\ \mu$ long. Internal malae, tectum and pedipalps as in female.

Dorsal shield ($648\ \mu \times 456\ \mu$) with 39 pairs of setae distributed as in Text-fig. 2G. Surface of shield reticulated; no hypertrichy; two pairs of *r* and five pairs of *R* setae on the cuticle.

Tritosternum with base $45\ \mu$, laciniae $108\ \mu$. Holovenal shield ($516\ \mu \times 144\ \mu$) with four pairs of setae and three pairs of pores in the sternal region; six pairs of setae in the genito-ventral region. Between *st*1, $30\ \mu$; between *st*1 and *st*3, $102\ \mu$. Paranal setae $45\ \mu$, postanal seta $84\ \mu$. Peritreme extends to posterior margin of coxa I; peritrematal shield fused anteriorly with dorsal shield; posterior part free.

Chaetotaxy of legs as in female. Tarsi II and III with setae *al*₁, *pl*₁, *av*₁, and also *av*₂, relatively shorter and stouter than the corresponding setae in the female. Tarsus IV has two short, stout, blunt setae, *al*₁ and *pv*₁. Coxal setae as in Text-fig. 2H. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	78/66	84/72	63/57	102/66
tibia	75/48	66/64	60/50	96/63
tarsus	102/36	90/40	102/36	147/42

HABITAT : Found mainly on species of the genus *Microtus* in Britain, Europe and the U.S.S.R. Also recorded from a weasel in Germany.

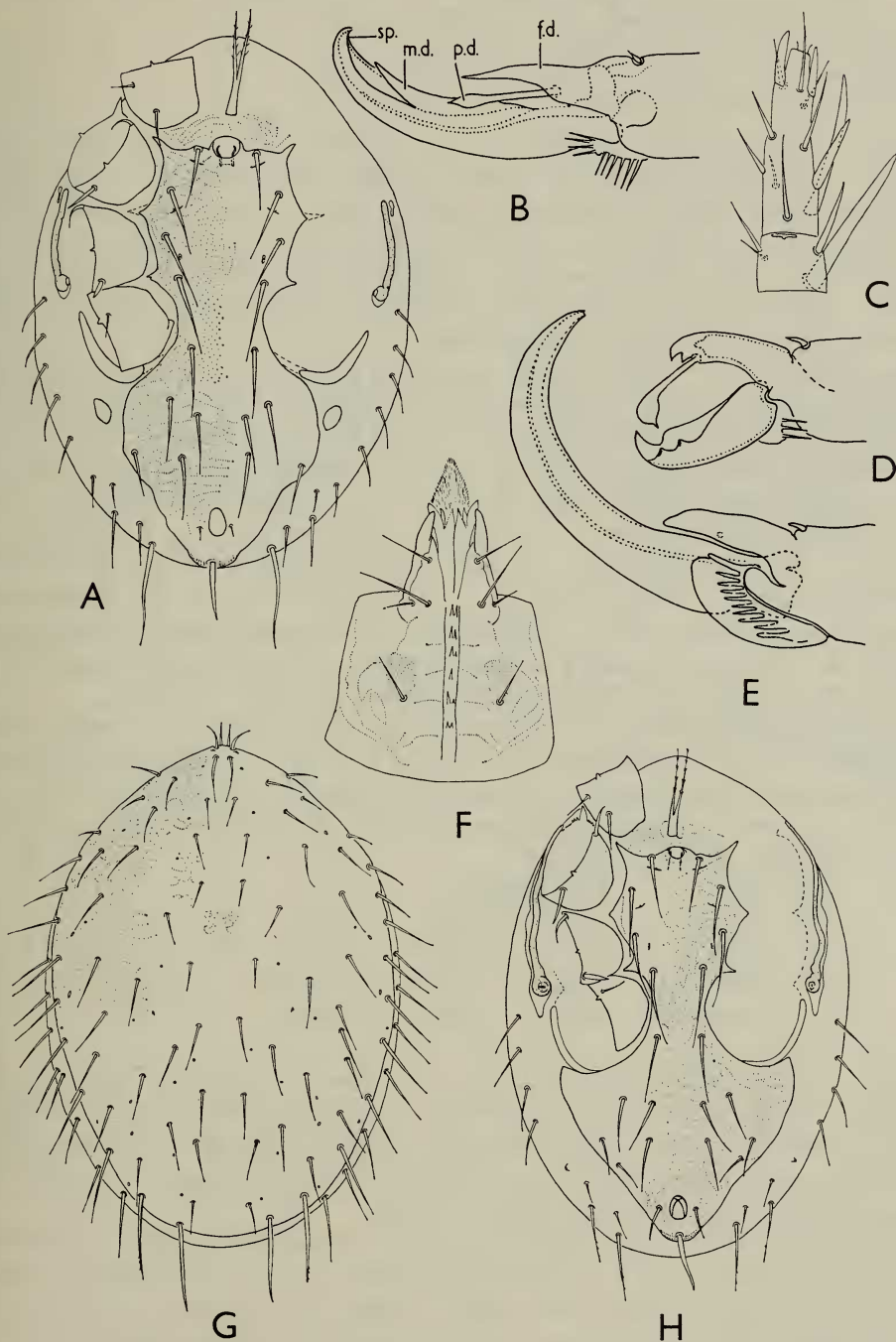


FIG. 2. A. *Laelaps agilis* Koch, venter of male; B. *Laelaps hilaris* Koch, chelicera of male; C. *L. agilis*, tarsus IV of male; D. *L. hilaris*, chelicera of female; E. *L. agilis*, chelicera of male; F. *L. hilaris* female, venter of gnathosoma; G. *L. hilaris* female, venter of idiosoma; H. *L. hilaris* male, venter of idiosoma.

Laelaps agilis Koch

Laelaps agilis Koch, 1836, *Deutschl. C.M.A.* **4** : 19.

Tipton, 1960, *Univ. Calif. Publ. Entomology* **16** : 265, figs.

Laelaps festinus Koch, 1838, *Deutschl. C.M.A.* **24** : 7.

Laelaps hilaroides Oudemans, 1928, *Ent. Ber. Amst.* **7** : 375.

Strandmann, 1963, *J. Kansas ent. Soc.* **36** : 5, figs. 17-18.

Female : Chelicera with segment I, 66 μ ; II, 123 μ ; movable digit 33 μ , bidentate ; fixed digit unidentate ; pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about 50 μ apart ; *hyp.* 2 about 45 μ apart. Deutosternum with seven transverse rows of denticles (1-2 per row) ; corniculi 27 μ long ; internal malae with smooth margins. Tectum capituli with free margin rounded, smooth ; salivary styli conspicuous, extending a little beyond tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (636 $\mu \times$ 456 μ) with 39 pairs of setae distributed as in Text-fig. 1A. Setae *Z*₅ considerably longer and stouter than *J*₅ or *S*₅. Surface of shield reticulate ; no hypertrichy. Cuticle with two pairs of *r* and seven pairs of *R* setae.

Tritosternum with base 57 μ , laciniae 100 μ . Sternal shield (123 $\mu \times$ 192 μ) with three pairs of setae and two pairs of pores ; metasternal setae situated on small shields, their associated pores on the cuticle. Between *st*₁, 90 μ ; between *st*₁ and *st*₃, 114 μ . Genital shield (147 $\mu \times$ 168 μ) flask-shaped, with four pairs of setae. Between *gen.*, 126 μ ; between *Jv*₂, 72 μ . Anal shield (110 $\mu \times$ 144 μ) with paranal setae 27 μ , postanal seta 105 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 1B. Peritreme extends to anterior third of coxa II ; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Chaetotaxy of legs differs from normal pattern in that genu IV bears a postero-ventral seta and two postero-lateral setae (2— $\frac{2}{1}$, $\frac{3}{1}$ —2). Femur I bears extremely long dorsal setae (*ad*₁ and *pd*₁) ; on tarsus II, setae *al*₁ and *pl*₁, and on tarsus III, setae *al*₁₋₃ are stout ; on tarsus IV setae *al*₁ and *pv*₁ are stouter than setae *pl*₁ and *av*₁. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	87/63	78/68	50/50	75/48
tibia	72/54	60/60	45/48	72/42
tarsus	90/40	84/42	114/42	153/36

Male : Chelicera with segment I, 50 μ ; II, 120 μ ; spermadactyl about 84 μ long, separate movable digit not present (Text-fig. 2E). Four pairs of gnathosomal setae with c.s. about 48 μ apart ; *hyp.* 2 about 36 μ apart. Deutosternum with six rows of denticles (1-2 per row) ; corniculi 33 μ long, weakly sclerotized. Internal malae, salivary styli, tectum and pedipalps as in female.

Dorsal shield (612 $\mu \times$ 432 μ) with 39 pairs of setae as in female. Tritosternum with base 42 μ , laciniae 90 μ . Holoventral shield (516 $\mu \times$ 162 μ) with four pairs of setae and three pairs of pores in the sternal region ; five pairs of setae in the genito-ventral region. Between *st*₁, 72 μ ; between *st*₁ and *st*₃, 114 μ . Paranal setae 18 μ ,

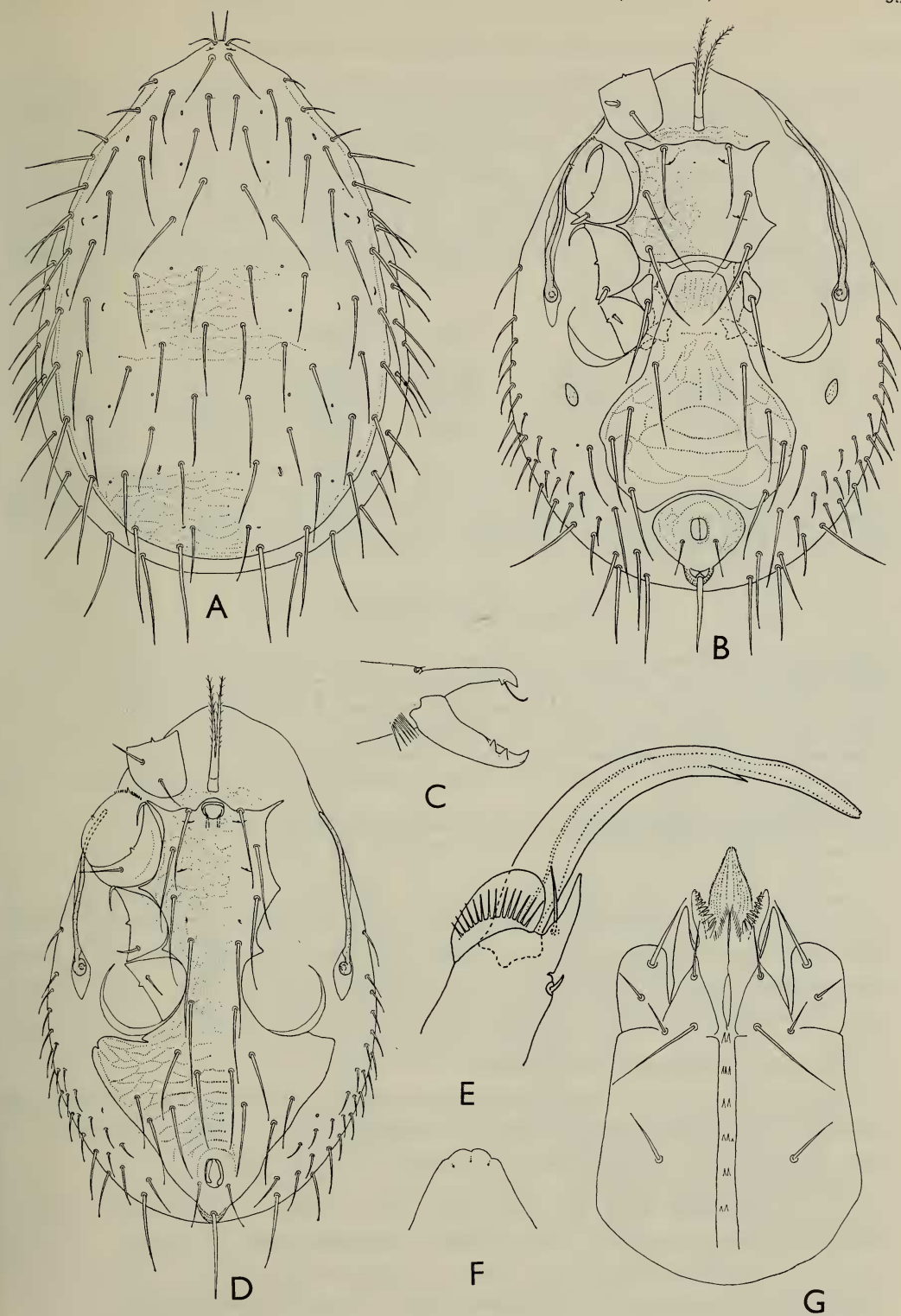


FIG. 3. *Laelaps echidnina* Berlese. A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. chelicera of female; D. venter of idiosoma of male; E. chelicera of male; F. tectum capituli of female; G. venter of gnathosoma of female.

postanal seta $70\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 2A. Peritreme extends to posterior margin of coxa II; anterior part of peritrematal shield not developed; posterior part very short, free.

Chaetotaxy of legs as in female. Setae al_1 , pl_1 and av_2 on tarsus II, setae al_1 and av_2 on tarsus III, short, stout and blunt. Tarsus IV has setae al_1 and pv_1 stout and blunt; al_2 and al_3 stout and spine-like; ad_2 and ad_3 very long, thick and sword-like (Text-fig. 2C). Femur I with setae ad_1 and pd_1 very long and thick. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	80/70	80/66	63/57	87/60
tibia	66/56	60/63	50/54	80/54
tarsus	75/40	80/45	96/42	147/42

HABITAT: Found on *Apodemus flavicollis* (Melchior) and *Apodemus sylvaticus* (Linn.) in Britain, Europe, Iceland and the U.S.S.R. *L. hilaroides* was recorded from a bat, *Eptesicus serotinus* (Schreber) in Germany.

Laelaps echidnina Berlese

Laelaps (Iphis) echidninus Berlese, 1887, *Acari, Myr. Scorp. Ital.* fasc. 39, no. 1.

Echinolaelaps echidninus: Strandtmann & Mitchell, 1963, *Pacific Insects* 5: 547, fig. 1.

Laelaps pallidus Trägårdh, 1931, *Nat. Hist. Juan Fernandez* 3: 616, figs. 145-147.

Laelaps berlesei Fonseca, 1939, *Mem. Inst. Butantan* 12: 104.

Echinolaelaps echidninus vitzthumi Turk, 1950, *Parasitology* 40: 71, fig. 7.

Echinolaelaps hirsti Turk, 1950 (nom. nov. pro *L. echidninus* Hirst, 1913, non Berlese, 1887),

Parasitology 40: 72, fig. 6.

Echinolaelaps hirsti ceylonicus Turk, 1950, *Parasitology* 40: 72, figs. 9-10.

Echinolaelaps flavioi Tipton 1960, *Univ. Calif. Publ. Ent.* 16: 288.

Female: Chelicera with segment I, $120\ \mu$; II, $228\ \mu$; movable digit $72\ \mu$, bidentate; fixed digit unidentate (Text-fig. 3C); pilus dentilis long and slender. Four pairs of gnathosomal setae with c.s. about $96\ \mu$ apart; $hyp.2$ about $84\ \mu$ apart. Deutosternum with six transverse rows of denticles (2-3 per row); corniculi $54\ \mu$ long; internal malae fringed (Text-fig. 3G). Tectum capituli with smooth anterior margin (Text-fig. 3F). Salivary styli conspicuous, reaching tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield ($1008\ \mu \times 648\ \mu$) with the normal 39 pairs of setae distributed as in Text-fig. 3A; no hypertrichy. Surface of shield reticulate; with eleven pairs of *R* setae on the cuticle. Marginal setae on scutum and cuticle barbed.

Tritosternum with base $84\ \mu$, laciniae $192\ \mu$. Sternal shield ($234\ \mu \times 240\ \mu$) extends to middle of coxa III, with three pairs of setae and two pairs of pores. Metasternal setae situated on small shields, associated pores on cuticle. Between *st1*, $132\ \mu$; between *st1* and *st3*, $204\ \mu$. Genital shield ($258\ \mu \times 216\ \mu$) greatly expanded behind coxae IV (maximum width $396\ \mu$), bearing four pairs of setae.

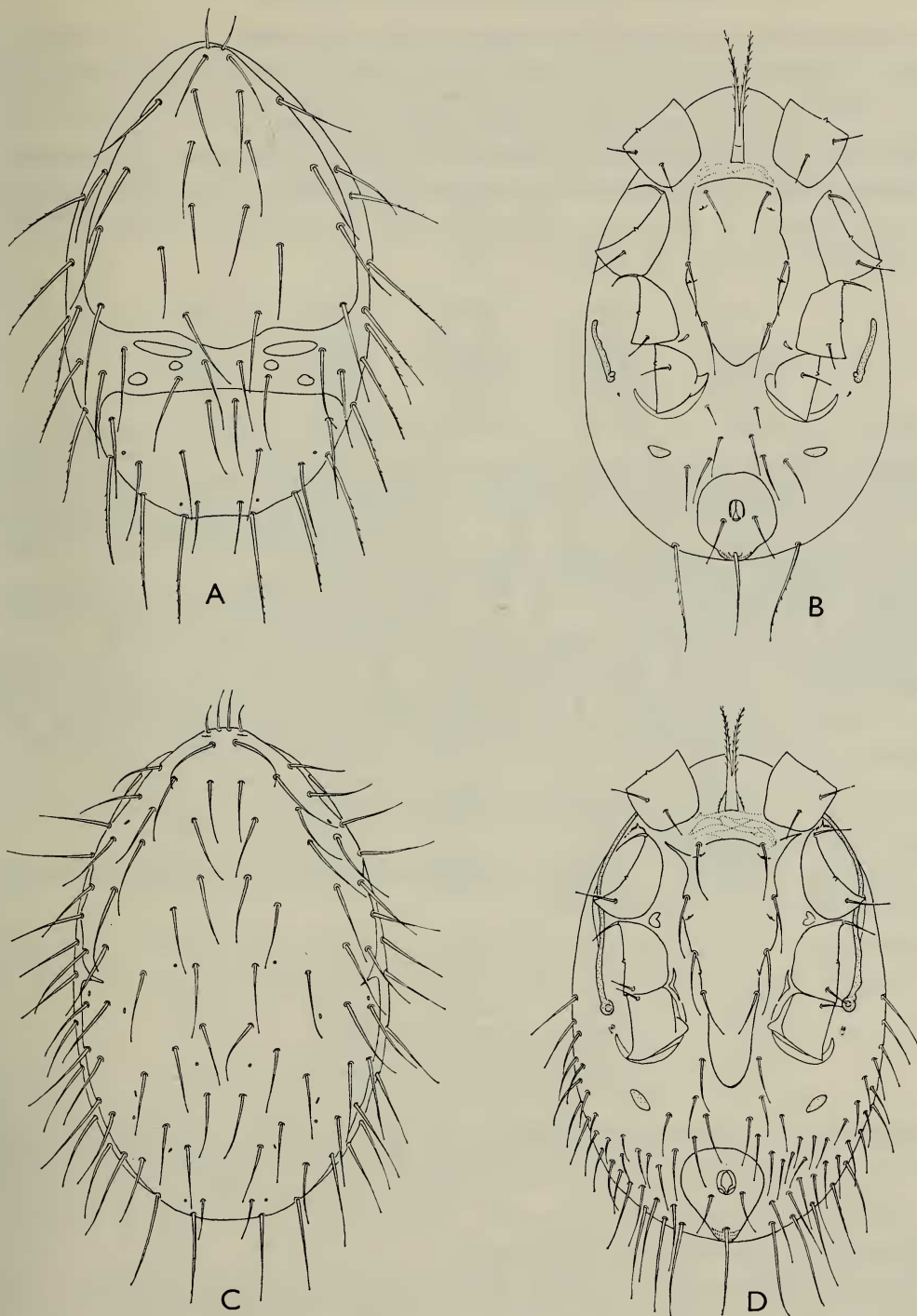


FIG. 4. *Laelaps echidnina* Berlese. A. Dorsum of idiosoma of protonymph; B. venter of idiosoma of protonymph; C. dorsum of idiosoma of deutonymph; D. venter of idiosoma of deutonymph.

Between *gen*, 180 μ ; between *Jv2*, 276 μ . Anal shield (168 $\mu \times$ 190 μ), paranal setae 72 μ , postanal seta 162 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 3B. Peritreme extends to posterior margin of coxa I; peritrematal shield fused anteriorly with dorsal shield, posterior part free.

Chaetotaxy of legs differs from normal pattern only in having two postero-lateral setae on genu IV. Setae on tarsi II–IV thick and spine-like; the following setae are stout and blunt: *al*₁ and *pl*₁ on tarsus II, *al*₁₋₂ on tarsus III, *al*₁ on tarsus IV. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	120/75	120/90	99/72	117/66
tibia	120/57	108/78	102/66	129/63
tarsus	165/48	150/54	192/50	270/50

Male: Chelicera with segment I, 75 μ ; II, 126 μ ; both digits edentate, movable digit 102 μ ; spermadactyl as in Text-fig. 3E. Four pairs of gnathosomal setae with c.s. about 66 μ apart; *hyp.2* about 72 μ apart. Deutosternum, tectum and pedipalps as in female; corniculi longer and more attenuate.

Dorsal shield (840 $\mu \times$ 492 μ) with the normal 39 pairs of setae; no hypertrichy. Surface of shield reticulated; marginal setae on shield and cuticle barbed.

Tritosternum with base 60 μ , laciniae 150 μ . Holovenal shield (684 $\mu \times$ 174 μ) greatly expanded behind coxae IV, with four pairs of setae and three pairs of pores in the sternal region, six pairs of setae in the genito-ventral region (Text-fig. 3D). Between *st1*, 84 μ ; between *st1* and *st3*, 150 μ . Paranal setae 72 μ ; postanal seta 140 μ . Peritreme extends to anterior margin of coxa II; anterior part of peritrematal shield fused with dorsal shield from a point a little posterior to the tip of the peritreme; posterior part free.

Chaetotaxy of legs as in female, but stout setae on tarsi II–IV are all pointed. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	120/72	120/84	102/66	114/66
tibia	120/60	108/72	102/60	126/60
tarsus	174/54	144/50	180/48	246/48

Protonymph: Chelicera with segment I, 75 μ ; II, 135 μ ; movable digit 45 μ , bidentate; fixed digit unidentate. Four pairs of gnathosomal setae with c.s. about 66 μ part, *hyp.2* about 70 μ apart. Corniculi 45 μ long; deutosternum with six transverse rows of denticles (1–3 per row); internal malae and tectum as in female. Pedipalp (1–4–5–12) with two-tined apotele.

Podonotal shield (444 $\mu \times$ 372 μ) with eleven pairs of setae; pygidial shield (192 $\mu \times$ 350 μ) with eight pairs of setae, the marginal ones being barbed. Chaetotaxy and sclerotization of mesonotal region as in Text-fig. 4A.

Tritosternum with base $60\ \mu$, laciniae $135\ \mu$. Sternal shield ($255\ \mu \times 162\ \mu$) with three pairs of setae and two pairs of pores; between *st*1, $96\ \mu$; between *st*1 and *st*3, $102\ \mu$. Anal shield ($130\ \mu \times 123\ \mu$) with paranal setae $78\ \mu$, postanal seta $144\ \mu$ long. Peritreme extends at least to middle of coxa III (Text-fig. 4B).

Chaetotaxy of legs normal; many of the setae stout and spine-like; particularly long setae on femora I and II (distal dorsals) and on dorsal surface of genu, tibia and tarsus IV. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	96/78	96/84	78/66	84/60
tibia	100/57	84/72	72/60	84/54
tarsus	168/42	150/48	162/48	207/45

Deutonymph: Chelicera with segment I, $90\ \mu$; II, $168\ \mu$; chelae as in female, movable digit $54\ \mu$. Four pairs of gnathosomal setae with *c.s.* about $78\ \mu$ apart; *hyp*.2 about $78\ \mu$ apart. Corniculi, deutosternum, internal malae and tectum as in protonymph. Pedipalps as in female.

Dorsal shield ($876\ \mu \times 504\ \mu$) with the normal 39 pairs of setae; six pairs of *R* setae on the cuticle. Marginal setae on shield and cuticle barbed (Text-fig. 4C).

Tritosternum with base $90\ \mu$, laciniae $150\ \mu$. Sternal shield ($432\ \mu \times 168\ \mu$) with four pairs of setae and three pairs of pores. Between *st*1, $114\ \mu$; between *st*1 and *st*3, $192\ \mu$. Anal shield ($150\ \mu \times 156\ \mu$) with paranal setae $75\ \mu$, postanal seta $168\ \mu$. Peritreme extends to posterior third of coxa I (Text-fig. 4D).

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	108/70	105/78	87/66	100/60
tibia	114/60	90/72	90/63	108/54
tarsus	174/48	138/54	186/50	228/50

HABITAT: Cosmopolitan, chiefly on rodents of the genus *Rattus*. Also recorded from the genera *Mus* and *Bandicota* and from the tree-shrew, *Tupaia glis* (Diard).

Laelaps muris (Ljungh)

Acarus muris Ljungh, 1799, *Nova Act. Reg. Soc. Sci. Uppsala* **6**: 10.

Laelaps muris: Tipton, 1960, *Univ. Calif. Publ. Ent.* **16**: 277, figs.

Laelaps arvicola George, 1889, *Science Gossip* **25**: 6, figs. 1-2.

Laelaps crassipes Schrank, Oudemans, 1897, *Tijdschr. Ent.* **39**: 135.

Laelaps microti Oudemans, 1916, *Ent. Ber. Amst.* **4**: 309.

Laelaps agilis (Koch) Hirst, 1916, *J. Zool. Res.* **1**: 67.

Female: Chelicera with segment I, $70\ \mu$; II, $110\ \mu$; movable digit $32\ \mu$, bidentate; fixed digit unidentate, pilus dentilis inflated, elongate, tapering abruptly at the tip (Text-fig. 5E). Four pairs of gnathosomal setae with *c.s.* about $78\ \mu$ apart, *hyp*.2 about $54\ \mu$ apart. Deutosternum with six rows of deutosternal denticles (1-2

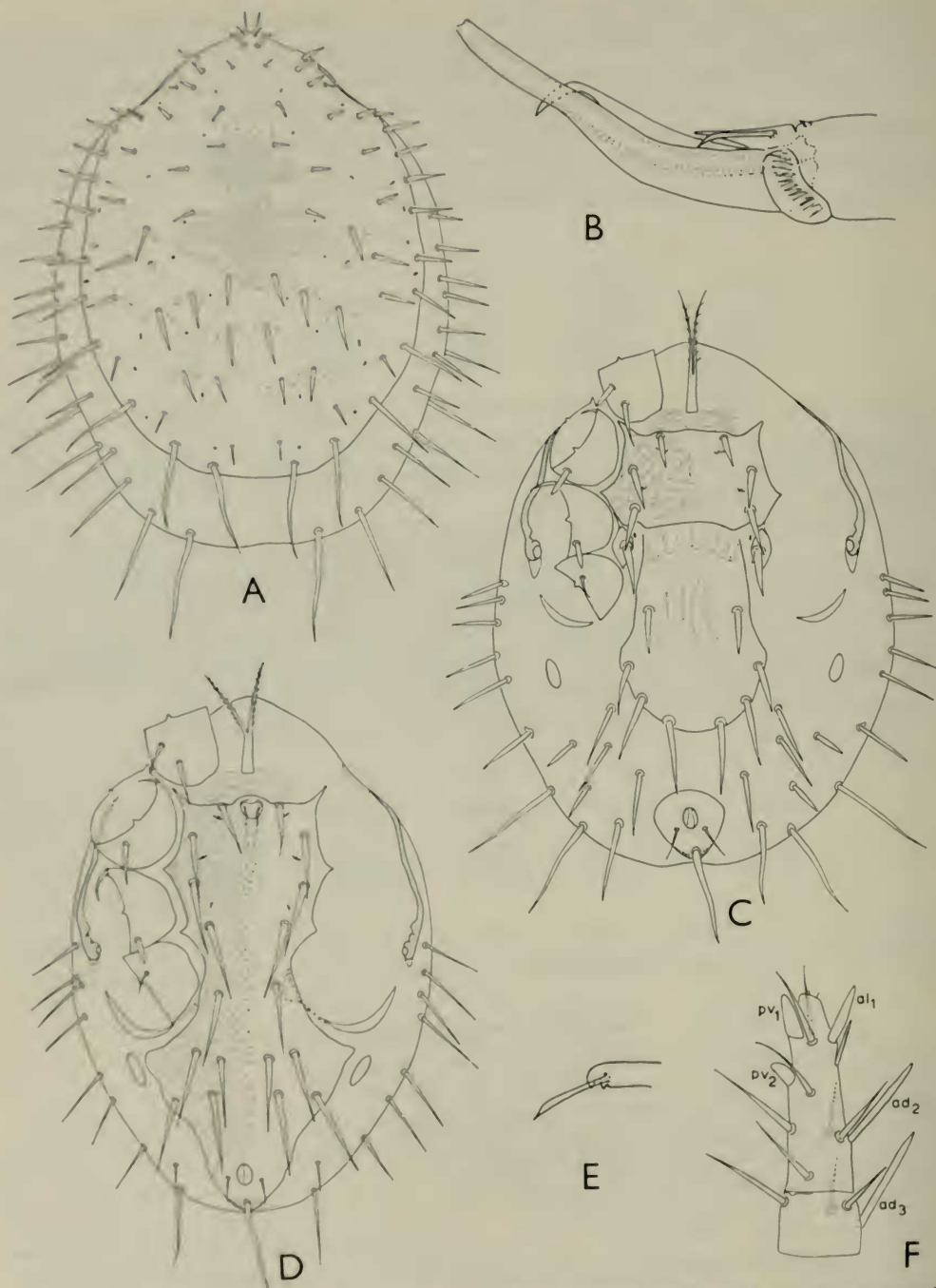


FIG. 5. *Laelaps muris* (Ljungh). A. Dorsum of idiosoma of female; B. chelicera of male; C. venter of idiosoma of female; D. venter of idiosoma of male; E. pilus dentilis of female; F. tarsus IV of male, ventral view.

per row); corniculi $30\ \mu$ long; internal malae with inner processes fringed, outer smooth. Tectum capituli with free margin rounded, smooth. Salivary styli extend slightly beyond tips of corniculi. Pedipalp (2-5-6-14) with two tined apotele.

Dorsal shield ($660\ \mu \times 492\ \mu$) with 39 pairs of setae distributed as in Text-fig. 5A. Most setae short and spine-like, setae Z_5 and S_3-5 at least twice as long as seta J_1 . Surface of shield granular, weakly reticulate laterally; no hypertrichy; two pairs of r and ten pairs of R setae on the cuticle.

Tritosternum with base $60\ \mu$, laciniae $126\ \mu$. Sternal shield ($144\ \mu \times 222\ \mu$) with three pairs of short, spine-like setae and two pairs of pores; metasternal setae on small shields, associated pores on cuticle. Between st_1 , $93\ \mu$; between st_1 and st_3 , $120\ \mu$. Genital shield ($180\ \mu \times 174\ \mu$) flask-shaped with four pairs of setae; between $gen.$, $140\ \mu$; between Jv_2 , $84\ \mu$. Anal shield ($96\ \mu \times 110\ \mu$) with paranal setae $63\ \mu$, postanal seta $168\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 5C. Peritreme extends beyond posterior margin of coxa I; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Chaetotaxy of legs differs from normal pattern in that genu IV has two postero-lateral setae, seta pl_2 being considerably shorter than pl_1 ; tarsi II-IV with setae ad_1 and pd_1 . Femur I with setae ad_1 and pd_1 stout and sinuous, the latter very long. Setae av_1 , al_1 and pl_1 on tarsi II and III stout and blunt. Setae al_2 and al_3 on tarsus III and the ventral and lateral setae on tarsus IV stout and spine-like. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	90/70	90/70	60/54	102/54
tibia	75/58	66/63	50/50	90/50
tarsus	96/45	90/48	114/42	153/42

Male: Chelicera with segment I, $48\ \mu$; II, $87\ \mu$; both digits edentate; movable digit about $70\ \mu$ long, $84\ \mu$ with spermadactyl (Text-fig. 5B). Four pairs of gnathosomal setae with c.s. about $63\ \mu$ apart; $hyp.2$ about $48\ \mu$ apart. Corniculi $33\ \mu$ long; salivary styli extend approximately to tips of corniculi. Deutosternum, internal malae, tectum and pedipalps as in female.

Dorsal shield ($636\ \mu \times 462\ \mu$) with 39 pairs of setae; one pair of r and six pairs of R setae on the cuticle. Tritosternum with base $45\ \mu$, laciniae $114\ \mu$. Holovenal shield ($546\ \mu \times 180\ \mu$) with four pairs of setae and three pairs of pores in the sternal region; five pairs of setae in the genito-ventral region. Between st_1 , $78\ \mu$; between st_1 and st_3 , $108\ \mu$. Paranal setae $36\ \mu$, postanal seta $130\ \mu$. Surface of shield reticulate and granular. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 5D. Peritreme extends to posterior margin of coxa I; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Chaetotaxy of legs and form of setae as in female. In addition, seta av_2 on tarsus II is stout and blunt. Tarsus IV with setae pv_1 and pv_2 stout and blunt; setae al_1 , ad_2 and ad_3 stout and blade-like (Text-fig. 5F), genu and tibia IV each with a stout blade-like seta al_2 . Length/width (in μ) of leg segments:

	I	II	III	IV
genu	90/63	90/78	66/60	114/66
tibia	75/54	66/66	57/57	99/63
tarsus	93/44	84/45	105/45	140/45

HABITAT: Found in Britain, Europe and the U.S.S.R., mainly on *Arvicola terrestris* (Linn.). Also recorded from *Microtus arvalis* (Pallas) and *Talpa europaea* Linn.

Genus *HYPERLAELAPS* Zachvatkin

Hyperlaelaps Zachvatkin, 1948, *Parazit. Sb.* 10: 61.

Type: *Tetragonyssus microti* Ewing, 1933.

Small, medium sclerotized mites ranging from 500 to 600 μ in length. Chelicerae chelate-dentate in the female with the movable digit bidentate. Fixed digit in the male markedly reduced, edentate; movable digit entirely fused with the extremely elongated spermadactyl. Pilus dentilis long, not inflated distally. Dorsal seta and fissures normal. Arthrodial processes at base of movable digit in female few in number and long. Chaetotaxy of venter of gnathosoma normal; chaetotaxy of pedipalp deficient (2-4/5-6-13/14); apotele two-tined. Deutosternum with six or seven rows of denticles, one or two denticles per row. Corniculi horn-like. Tectum membranous, with rounded or lobate anterior margin, never denticulate.

Dorsal shield entire and with 37 (px_2 and px_3 lacking) or 38 (px_3 lacking) pairs of setae. Majority of dorsal setae short and subspinose.

Tritosternum normal, bipartite. No definite pre-endopodal shields. Sternal shield in female with three pairs of setae and two pairs of pores; metasternal setae on distinct shields. Genito-ventral shield inflated posterior to coxae IV and bearing four pairs of setae. Anal shield truncate anteriorly with normal setation. Opisthogastric cuticle with a maximum of twelve pairs of setae; male with fewer setae than the female. Peritrematal shield poorly developed, free posteriorly. Metapodal shields present. Male with sternito-genito-ventral shield bearing ten pairs of setae, anal shield free. Podal shields weakly developed posterior to coxae IV.

Chaetotaxy of legs normal except genu III ($2-\frac{2}{1}$, $\frac{2}{0}-1$), tibia III in *H. amphibia* ($1-\frac{1}{1}$, $\frac{2}{1}-1$) and genu IV ($2-\frac{2}{1}$, $\frac{3}{0}-2$). Femora I and II in both sexes with ad_1 at least three times the length of pd_1 . Coxa II with anterior spine.

Zachvatkin (1948) proposed *Hyperlaelaps* as a subgenus of *Laelaps* with *Laelaps* (*Hyperlaelaps*) *arvalis* Zachvatkin as the type. In recent revisionary works on this group (Strandtmann & Wharton, 1958 and Tipton, 1960) this subgenus has been synonymized with *Laelaps*. Detailed studies of the chaetotaxy of the species included in *Hyperlaelaps* have shown that they are not congeneric with the species of *Laelaps*.

There is some confusion, at present, concerning the name of the type species. Koch (1839) described *Laelaps pachypus* from the field mouse ("*Lemmus arvalis*"), believing it to be conspecific with *Acarus pachypus* Hermann, 1804. The first

accurate description and figure of *Laelaps pachypus* sensu Koch may be attributed to Hirst (1916). Later Oudemans (1927), without reference to Hirst, re-described both sexes of what he considered to be *Laelaps pachypus* sensu Koch. Unfortunately two related species are confused in his description, the male (from *Microtus arvalis*) being referable to *Laelaps pachypus* sensu Hirst, and the female (from *Arvicola amphibius*) to a species which has subsequently been described as *Laelaps (Hyperlaelaps) amphibius* by Zachvatkin (1948). We have examined Oudemans' material of *L. pachypus* and can confirm that these two species were represented in the material he had before him in 1927. In 1936 Oudemans correctly pointed out that Koch (1839) has misidentified *Acarus pachypus* Hermann and proposed a new name, *Laelaps kochi*, for *Laelaps pachypus* sensu Koch. On the basis of the type host and of the figures of *pachypus* by Hirst (1916) we consider *L. (H.) arvalis* Zachvatkin to be a synonym of *Laelaps kochi* Oudemans.

Recently we have had the opportunity, through Dr. Crabill, Smithsonian Institution, of examining the "cotype" material of *Tetragnyssus microti* Ewing from *Microtus californicus*, Los Angeles, California, and from *Microtus* sp., Alaska. We are unable to separate morphologically Ewing's species from *Laelaps kochi* Oudemans taken from *Microtus arvalis* in Britain. We therefore consider *L. kochi* to be synonymous with *T. microti*.

KEY TO MALES AND FEMALES

- 1 Tibia III with chaetotactic formula ($2-\frac{1}{1}, \frac{2}{1}-1$). Palpfemur with five setae.
Dorsal shield with setae px_2 present or absent. In the female, seta s_6 short and spinose, seta S_1 relatively long and slender. ***H. microti*** (Ewing) (p. 141)
- Tibia III with chaetotactic formula ($1-\frac{1}{1}, \frac{2}{1}-1$). Palpfemur with four setae.
Dorsal shield usually with setae px_2 present. In the female, seta s_6 and S_1 both short and spinose. ***H. amphibia*** Zachvatkin (p. 144)

Hyperlaelaps microti (Ewing)

Laelaps pachypus Koch, 1839, *Deutschl. C.M.A.* **24** : 8 (non *Acarus pachypus* Hermann, 1804).
Hirst, 1916, *J. Zool. Res.* **1** (2) : 68, figs. 5-6.

Oudemans, 1927, *Tijdschr. Ent.* **70** : 179 (in part).

Tetragnyssus microti Ewing, 1933, *Proc. U.S. nat. Mus.* **82** (art. 30) : 9.

Laelaps kochi Oudemans, 1936, *Krit. Hist. Over. Acar.* **3** (A) : 244 (nom. nov. for *L. pachypus* Koch). [in part].

Laelaps (Hyperlaelaps) arvalis Zachvatkin, 1948, *Parazit. Sb.* **10** : 74, figs. 25-26 (**syn. nov.**).

Female : Chelicera with segment I, $54\ \mu$; II, $140\ \mu$; movable digit $36\ \mu$, bidentate ; fixed digit unidentate, pilus dentilis elongate, broad, not inflated distally (Text-fig. 7B). Four pairs of gnathosomal setae with c.s. about $66\ \mu$ apart, *hyp.* 2 about $48\ \mu$ apart. Deutosternum with seven rows of denticles (1-2 per row) ; corniculi $42\ \mu$ long ; internal malae with smooth margins. Tectum capituli with free margin rounded or slightly lobed in appearance. Pedipalp (2-5-5-13) with two-tined apotele.

Dorsal shield ($588\ \mu \times 444\ \mu$) with 37 pairs of setae distributed as in Text-fig. 6A, the setae of the *px* series being absent, more rarely px_2 present paired or unpaired.

Surface of shield granular, reticulate laterally; no hypertrichy; six pairs of *R* setae on the cuticle. Most of the setae are short and spine-like; those of the *S* series and seta *Z*₅ are considerably longer. Seta *s*₆ short and spine-like.

Tritosternum with base $45\ \mu$, laciniae $110\ \mu$. Sternal shield ($70\ \mu \times 192\ \mu$) with posterior margin deeply concave, lateral margins heavily sclerotized; with three

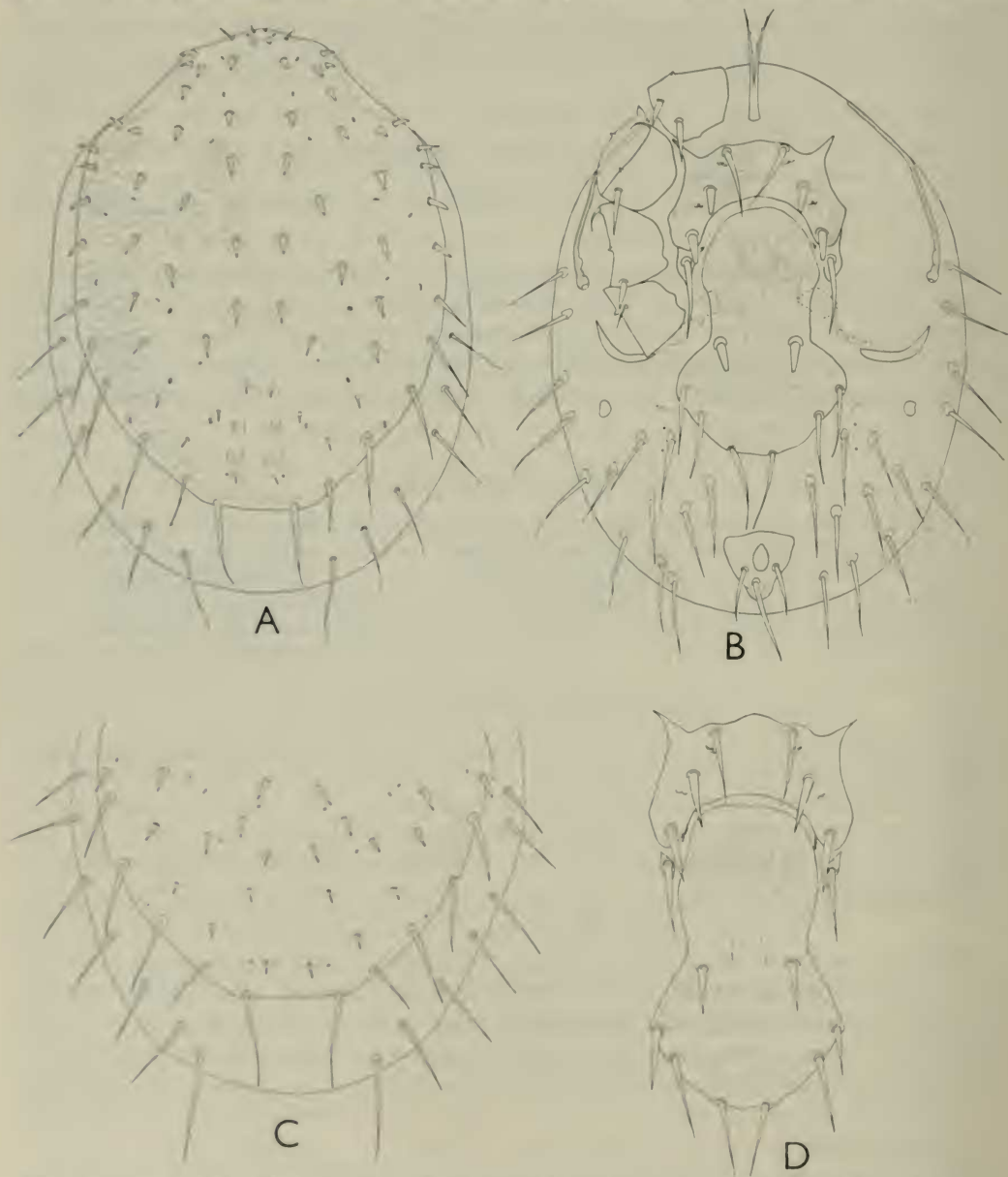


FIG. 6. A-B. *Hyperlaelaps micvoti* (Ewing), female; dorsum (A) and venter (B) of idiosoma. C-D. *Hyperlaelaps amphibia* Zachvatkin, female; opisthonotal region (C); sternal and genital-ventral shields (D).

pairs of setae and two pairs of pores. Setae 2 and 3 are short, with unevenly truncate tips which give the appearance of being broken; metasternal setae situated on small shields, associated pores on cuticle. Between $st1$, $70\ \mu$; between $st1$ and $st3$, $117\ \mu$. Genital shield flask-shaped ($135\ \mu \times 135\ \mu$), with four pairs of setae, expanded behind the genital setae and reaching its maximum width ($216\ \mu$) at level of $Zv1$. Between the short, truncate $gen.$, $96\ \mu$; between $Jv2$, $50\ \mu$. Anal shield ($70\ \mu \times 78\ \mu$) with maximum width ($87\ \mu$) at anterior margin. Paranal setae $78\ \mu$, postanal seta $108\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 6B, the setae being situated on small projections of the integument. Peritreme extends to posterior margin of coxa I; anterior part of peritrematal shield fused with dorsal shield; posterior part not visible.

The chaetotaxy of the legs differs from the normal pattern in three respects: genu III lacks seta pv ; genu IV has seta pl_2 ; tarsi II–IV lack setae ad_1 and pd_1 . Femur I with seta ad_1 at least three times as long as pd_1 ; femur II with seta ad_1 about three times as long as pd_1 . Many of the leg setae are reduced to short spines. Trochanter I with pv_2 short and stout; genu I with ad_3 and pd_3 relatively long and thick; trochanters III and IV with al and d stout; femur IV with ad_1 long and stout; tarsi II–IV with ventral and lateral setae relatively stout, tapering. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	80/84	84/72	54/57	90/57
tibia	69/63	57/69	45/54	80/50
tarsus	78/45	96/45	93/42	144/42

Male: Chelicera with segment I, $42\ \mu$; II, $75\ \mu$; spermadactyl $150\ \mu$; movable digit not visible (Text-fig. 7C). Four pairs of gnathosomal setae with *c.s.* about $57\ \mu$ apart; $hyp.2$ about $42\ \mu$ apart. Corniculi about $40\ \mu$ long, weakly sclerotized, membranous. Internal malae difficult to distinguish. Deutosternum, tectum and pedipalps as in female.

Dorsal shield ($504\ \mu \times 360\ \mu$) with 37 pairs of setae as in female; seven pairs of R setae on the cuticle.

Tritosternum with base $36\ \mu$; laciniae $90\ \mu$. Sternito-genito-ventral shield ($324\ \mu \times 150\ \mu$) with four pairs of setae and three pairs of pores in sternal region, six pairs of setae in genito-ventral region. Between $st1$, $54\ \mu$; between $st1$ and $st3$, $102\ \mu$. Anal shield ($60\ \mu \times 70\ \mu$) with maximum width ($80\ \mu$) at anterior margin. Paranal setae $48\ \mu$, postanal seta $75\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 7A. Peritreme extends about to anterior margin of coxa II; anterior part of peritrematal shield fused with dorsal shield; posterior part not developed.

Chaetotaxy of the legs as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	78/72	75/63	50/56	80/50
tibia	60/57	54/63	42/48	75/45
tarsus	72/42	80/42	84/40	132/40

HABITAT: Found in Britain on *Microtus arvalis* (Pallas), *M. agrestis* (Linn.) and *M. orcadensis* Millais. Recorded from Europe and the U.S.S.R. from the genus *Microtus*, from *Rattus rattus* (Linn.), *Apodemus sylvaticus* (Linn.) and "*Mustela vulgaris*".

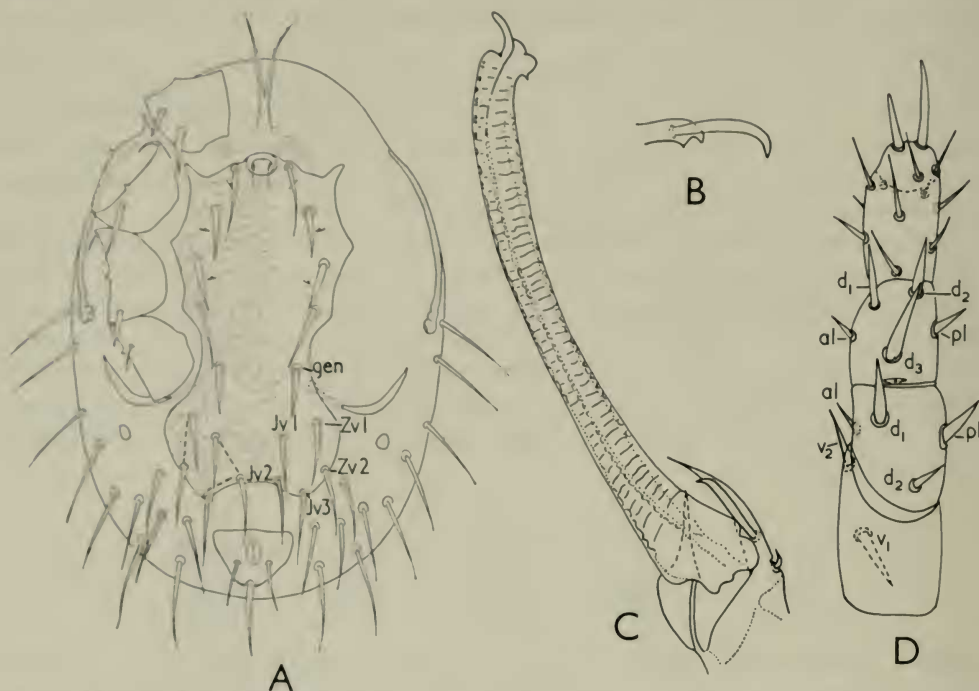


FIG. 7. A-C. *Hyperlaelaps microti* (Ewing); venter of idiosoma of male (A); pilus dentilis of female (B); chelicera of male (C). D. *Hyperlaelaps amphibia* Zachvatkin, female; right pedipalp (trochanter to tibia), dorsal view.

Hyperlaelaps amphibia Zachvatkin

Laelaps (Hyperlaelaps) amphibi Zachvatkin, 1948, *Parazit. Sb.* **10**: 74, figs. 22-24.

Laelaps pachypus (Koch) Oudemans, 1927, *Tijdschr. Ent.* **70**: 179 (in part).

Female: Chelicera with segment I, $50\ \mu$; II, $153\ \mu$; movable digit $36\ \mu$, bidentate; fixed digit unidentate, pilus dentilis elongate, band-like, with pointed tip. Four pairs of gnathosomal setae with c.s. about $66\ \mu$ apart, *hyp.2* about $54\ \mu$ apart. Deutosternum with six rows of denticles (1-2 per row); corniculi $30\ \mu$ long. Internal malae and tectum capituli as in *H. microti*. Pedipalp (2-4-5-13) with two-tined apotele (Text-fig. 7D).

Dorsal shield ($600\ \mu \times 408\ \mu$) with 38 pairs of setae, *px2* being present (Text-fig. 6C). Setae *s6* and *S1* both short and spine-like. Surface of shield granular, reticulate laterally; seven pairs of *R* setae on the cuticle.

Tritosternum with base $42\ \mu$, laciniae $117\ \mu$. Sternal shield ($84\ \mu \times 192\ \mu$) with setae 2 and 3 longer and more pointed than in *H. microti* (Text-fig. 6D); between *st1*,

78 μ ; between *st*1 and *st*3, 123 μ . Metasternal setae on small platelets, associated pores on cuticle, very close to sternal shield. Genital shield (150 μ $\times$ 162 μ) with maximum width (216 μ) at level of *Zv*1; between *gen.*, 102 μ ; between *Jv*2, 60 μ . Genital setae (*gen.*) more pointed than in *H. microti* (Text-fig. 6D). Anal shield (60 μ $\times$ 78 μ) with maximum width (102 μ) at anterior margin. Paranal setae 60 μ , postanal seta 96 μ long. Peritremes and chaetotaxy and sclerotization of opisthogaster as in *H. microti*.

Chaetotaxy of legs as in *H. microti* except that tibia III bears only one antero-lateral seta. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	90/75	90/84	54/63	90/54
tibia	66/60	60/72	40/54	84/45
tarsus	72/45	93/48	87/45	150/42

Male: Chelicera with segment I, 42 μ ; II, 120 μ ; spermadactyl 168 μ , movable digit not visible. Four pairs of gnathosomal setae with *c.s.* about 63 μ apart; *hyp.*2 about 48 μ apart. Corniculi about 54 μ long, weakly sclerotized. Internal malae difficult to distinguish. Deutosternum, tectum capituli and pedipalps as in female.

Dorsal shield (552 μ $\times$ 396 μ) with 38 pairs of setae as in female. Tritosternum with base 33 μ , laciniae 90 μ . Sternito-genito-ventral shield (372 μ $\times$ 168 μ) as in *H. microti*. Between *st*1, 63 μ ; between *st*1 and *st*3, 102 μ . Anal shield (63 μ $\times$ 75 μ) with maximum width (90 μ) at anterior margin. Paranal setae 45 μ , postanal seta 90 μ long. Chaetotaxy and sclerotization of opisthogaster as in *H. microti*. Peritreme extends to middle of coxa II.

Chaetotaxy of legs and form of setae as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	78/72	84/70	60/63	80/48
tibia	66/63	54/66	45/54	80/42
tarsus	72/48	84/45	90/45	135/38

HABITAT: Recorded from Britain, Europe and the U.S.S.R. on *Arvicola terrestris* (Linn.)

Genus *ONDATRALAELAPS* Evans & Till

Ondatralaelaps Evans & Till, 1965, *Bull. Brit. Mus. (nat. Hist.) Zool.* **13**: 269.

Type: *Laelaps multispinosa* Banks, 1909.

Medium sclerotized mites ranging from 650 μ to 750 μ in length and with the general facies of *Laelaps*. Chelicerae chelate-dentate in the female with the broad movable digit bidentate and the shorter fixed digit unidentate. Fixed digit in the male markedly reduced, edentate, movable digit partially fused with elongate grooved

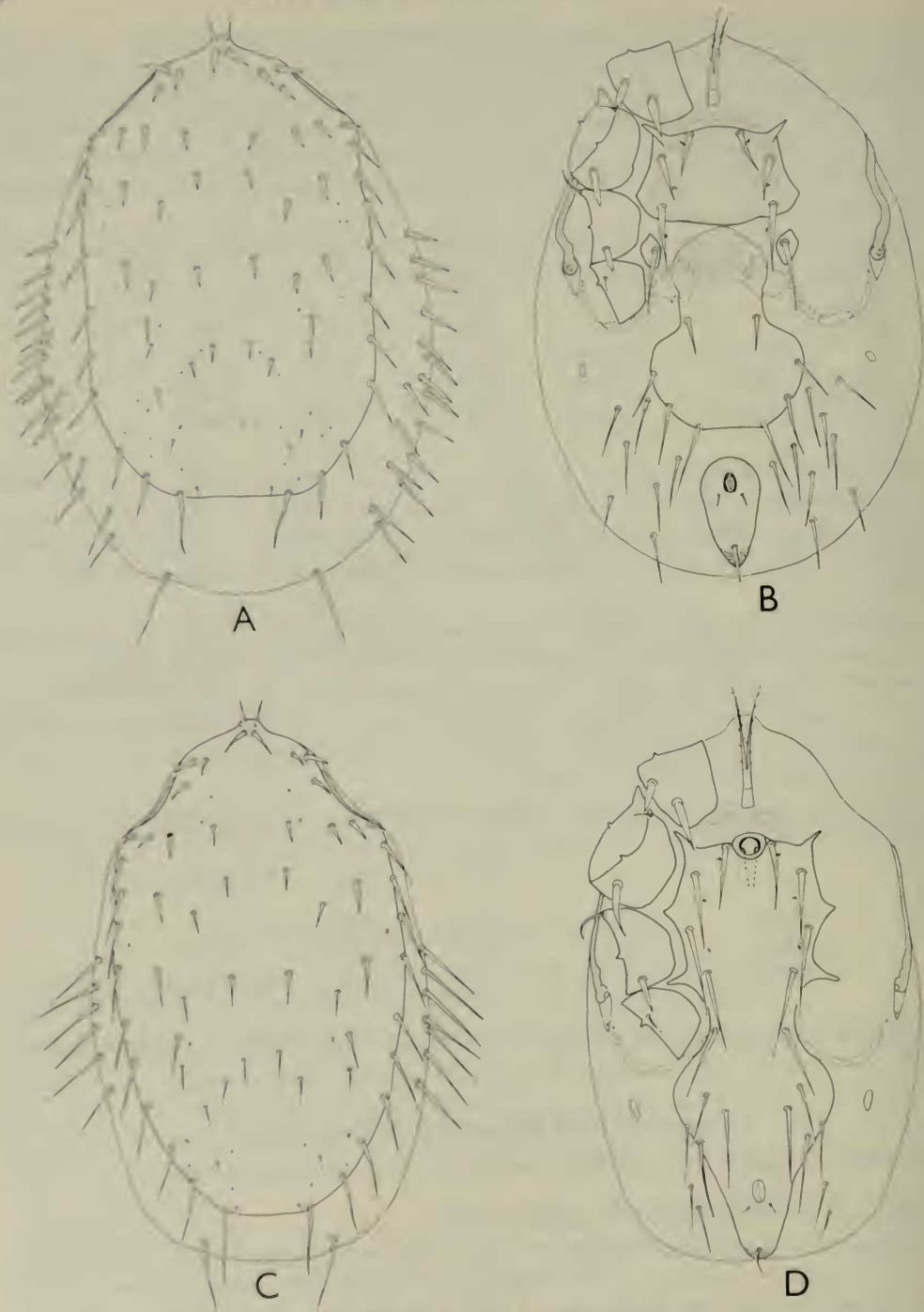


FIG. 8. *Ondatra laelaps multispinosa* (Banks). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. dorsum of idiosoma of male; D. venter of idiosoma of male.

spermadactyl. Pilus dentilis long, hooked distally. Dorsal seta and fissures normal. Arthrodial processes at base of movable digit present. Chaetotaxy of the venter of the gnathosoma normal; chaetotaxy of pedipalp deficient (2-5-5-14); apotele two-tined. Deutosternum with six transverse rows of denticles, one to three denticles per row. Corniculi horn-like; internal malae fimbriated. Tectum capituli tongue-shaped, margin smooth.

Dorsal shield entire with typically 32 pairs of setae, podonotal region with 20 pairs of setae, opisthonotal region with 12 pairs (j_3 , z_3 , J_3 , J_4 , Z_3 , px_2 and px_3 lacking in comparison with the typical form in *Laelaps*). Intraspecific variation of the opisthonotal chaetotaxy common. Dorsal setae in the female shorter and stouter than in the male. Sexual dimorphism affecting form and number of marginal setae (r and R) in the adult.

Tritosternum normal, bipartite. No definite pre-endopodal shields. Sternal shield in the female with three pairs of setae and two pairs of pores, metasternal setae on discrete platelets. Genito-ventral shield typically *Laelaps* with four pairs of setae. Anal shield elongate-oval in outline, paranal setae situated behind the anus. Opisthogastric cuticle with up to ten setae, variable. Peritrematal shields free posteriorly. Small metapodal shields present. Male with holoventral shield bearing nine pairs of setae excluding anals. Opisthogastric cuticle with about two pairs of setae. Podal shields weakly developed posterior to coxae IV.

Chaetotaxy of legs normal except for genu III ($2-\frac{2}{1}$, $\frac{2}{0}-1$) and genu IV ($2-\frac{2}{1}$, $\frac{3}{0}-2$). Coxa II with well-developed anterior spine. Femur I with ad_1 and pd_1 very stout and long, pd_1 arising from sclerotized protuberance (Text-fig. 9D). Certain setae on other segments tend to be stout. Ambulacra with claws reduced or absent.

Two species are included in this genus, the type species occurring on the Musk Rat, *Ondatra zibethica* (Linn.) in North America and Europe (introduced), and *Ondatra-laelaps evansi* (Tipton) *comb. nov.* from the Southern Musk Rat, *Neofiber alleni* True in Florida, U.S.A.

Ondatralaelaps multispinosa (Banks)

Laelaps multispinosus Banks, 1909, *Proc. ent. Soc. Wash.* **11** : 136; Bregetova, 1956, *Opred.*

Faune SSSR. **61** : 105.

Liponyssus spiniger Ewing & Stover, 1915, *Ent. News* **26** (3) : 109.

Tetragnonyssus spiniger: Ewing, 1922, *Proc. U.S. nat. Mus.* **62** (art. 13) : 10.

Laelaps parvanalis Willmann, 1952, *Z. Parasitenk.* **15** (5) : 398.

Female: Chelicera with segment I, 57 μ ; II, 117 μ ; movable digit 36 μ , bidentate; fixed digit reduced in size, with a terminal hook, pilus dentilis extremely elongate (Text-fig. 9E). Four pairs of gnathosomal setae with *c.s.* about 66 μ apart, *hyp.2* about 60 μ apart. Deutosternum with six transverse rows of denticles (one to three denticles per row); corniculi horn-like, 30 μ long; internal malae fimbriate (Text-fig. 9F). Tectum capituli tongue-shaped with anterior margin rounded, smooth. Pedipalp (2-5-5-14) with two-tined apotele.

Dorsal shield ($696 \mu \times 432 \mu$) with 32 pairs of setae distributed as in Text-fig. 8A; i_3 , z_3 , J_3 , J_4 , Z_3 , px_2 and px_3 lacking. Chaetotaxy of opisthonotal region variable. Most of the setae short and spinose. Surface of shield granular.

Tritosternum with base 48μ , laciniae 132μ . Sternal shield ($150 \mu \times 207 \mu$) with three pairs of setae and two pairs of pores. Metasternal setae on distinct shields. Between st_1 , 80μ ; between st_1 and st_3 , 120μ . Genital shield ($174 \mu \times 126 \mu$) flask-shaped, bearing four pairs of setae; between $gen.$, 105μ ; between Jv_2 , 99μ . Anal shield ($140 \mu \times 93 \mu$) elongate pear-shaped, with paranal setae situated posterior to the anus. Paranals 18μ long, postanal seta 57μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 8B. Peritreme extends to middle of coxa I. Peritrematal shield fused anteriorly with dorsal shield, posterior part free.

Chaetotaxy of legs normal except genu III, which lacks seta pv ($2-\frac{2}{1}$, $\frac{2}{0}-1$) and genu IV, which has two postero-lateral setae ($2-\frac{2}{1}$, $\frac{3}{0}-2$). Both setae on coxa I and posterior setae on coxae II-III stout and spine-like; coxa II with well-developed anterior spine. Many of the leg setae stout and spinose. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	96/82	90/78	57/63	80/54
tibia	72/60	63/63	51/54	82/48
tarsus	90/48	105/50	105/45	147/42

Male: Chelicera with segment I, 40μ ; II, 66μ ; movable digit 48μ long, partially fused with spermadactyl. Fixed digit greatly reduced, bearing an elongate pilus dentilis; both digits edentate (Text-fig. 9G). Four pairs of gnathosomal setae with c.s. about 57μ apart; $hyp.2$ about 48μ apart. Corniculi 30μ long; other gnathosomal structures as in female.

Dorsal shield ($612 \mu \times 360 \mu$) with 32 pairs of setae distributed as in Text-fig. 8C, the setae being relatively longer and more slender than in the female. Unsclerotized integument of dorsum bears seven to eight pairs of setae, one pair at the posterior margin and six to seven pairs on the mid-lateral margin.

Tritosternum with base 33μ , laciniae 66μ . Holovenral shield ($528 \mu \times 168 \mu$) with nine pairs of setae, excluding the anals. Between st_1 , 57μ ; between st_1 and st_3 , 117μ . Paranal setae 12μ long, postanal seta at least three times this length. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 8D. Peritreme extends to middle of coxa I; peritrematal shield fused anteriorly with dorsal shield, posterior part free.

Chaetotaxy of legs as in female. Stout, spine-like coxal setae relatively longer and more slender than in female. Tarsus IV of male with three stout, spur-like setae (Text-fig. 9B). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	90/75	75/75	60/63	90/60
tibia	72/60	54/60	50/54	88/54
tarsus	90/42	93/42	93/42	135/40

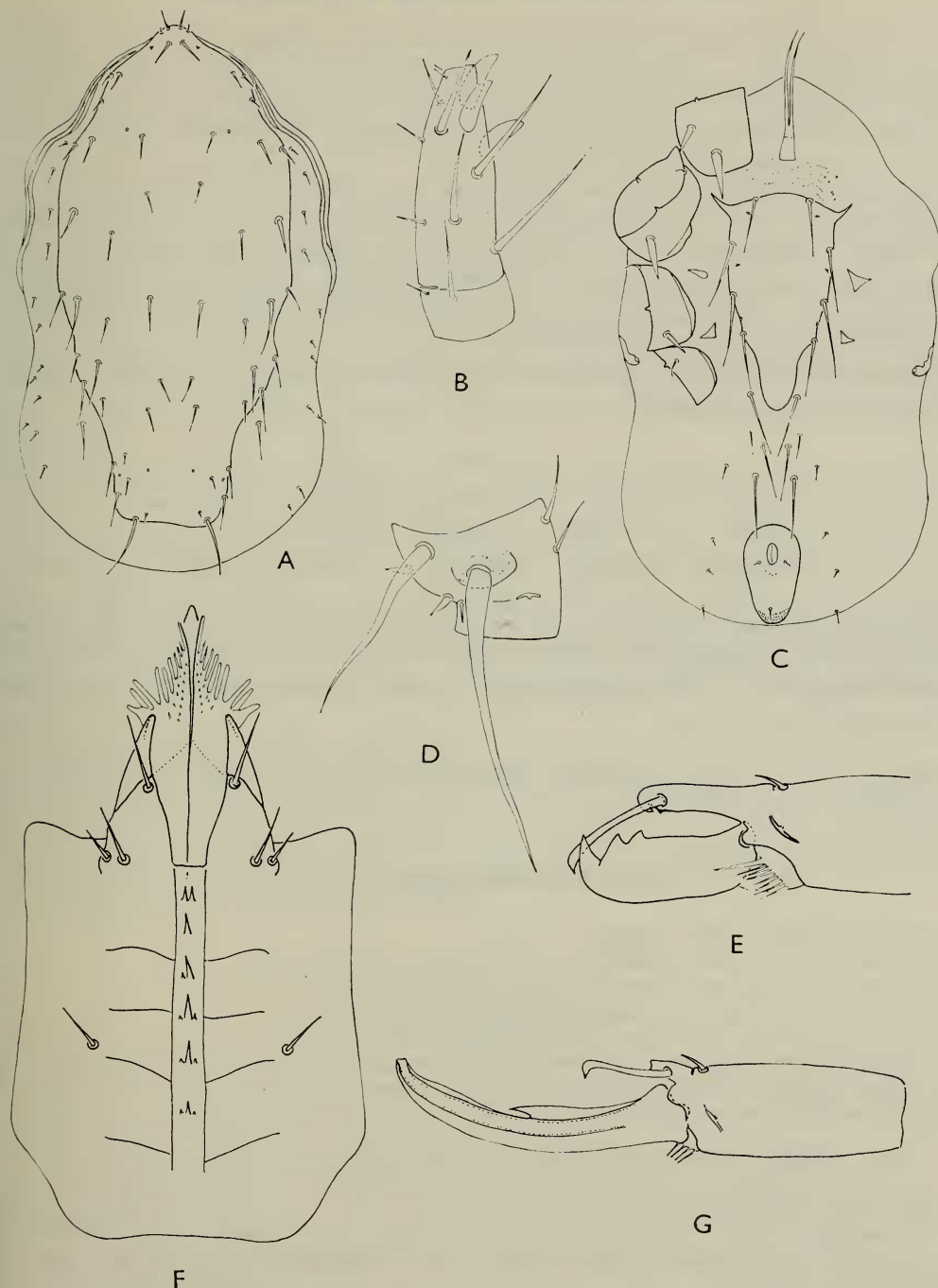


FIG. 9. *Ondatra laelaps multispinosa* (Banks). A. Dorsum of idiosoma of deutonymph (male); B. tarsus IV of male; C. venter of idiosoma of deutonymph (male); D. femur I of male, dorsal view; E. chelicera of female; F. venter of gnathosoma of female; G. chelicera of male.

Deutonymph (male): Chelicera with segment I, $36\ \mu$; II, $80\ \mu$; chelae as in female, movable digit $27\ \mu$. Four pairs of gnathosomal setae with c.s. about $54\ \mu$ apart; *hyp.* 2 about $45\ \mu$ apart. Gnathosomal structures generally as in female.

Dorsal shield ($540\ \mu \times 228\ \mu$) with 16 pairs of setae in the podonotal region, 11–12 pairs in the opisthonotal region (Text-fig. 9A).

Tritosternum with base $42\ \mu$, lacinae $100\ \mu$; Sternal shield ($240\ \mu \times 117\ \mu$) with four pairs of setae and three pairs of pores. Between *st*1, $60\ \mu$; between *st*1 and *st*3, $110\ \mu$. Anal shield ($96\ \mu \times 66\ \mu$); par- and postanal setae very short, about $8\ \mu$ and $10\ \mu$ long respectively. Opisthogastric cuticle with seven pairs of setae (Text-fig. 9C). Peritreme extends to middle of coxa I; peritrematal shields free anteriorly, poorly developed posteriorly.

Chaetotaxy of legs as in female, but setae not so markedly enlarged. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	78/72	66/66	45/57	63/50
tibia	63/58	50/57	45/50	63/45
tarsus	90/45	84/40	96/40	120/36

Deutonymph (female): Slightly larger than male deutonymph and with eleven pairs of setae on the opisthogastric cuticle. Chelicera with segment I, $45\ \mu$; II, $96\ \mu$; movable digit $36\ \mu$. Dorsal shield ($588\ \mu \times 240\ \mu$); sternal shield ($252\ \mu \times 126\ \mu$); anal shield ($96\ \mu \times 75\ \mu$).

HABITAT: The musk rat, *Ondatra zibethica* (Linn.) in North America, Britain and Germany.

Genus *ANDROLAELAPS* Berlese

Androlaelaps Berlese, 1903, *Zool. Anz.* **27**: 14.

Haemolaelaps Berlese, 1910, *Redia* **6**: 216; and 1916, *Redia* **12**: 170.

Atricholaelaps Ewing, 1929, *Manual of External Parasites*: 186.

Eubrachylaelaps Ewing, 1929, *Manual of External Parasites*: 186.

Ichtnolaelaps Fonseca, 1936, *Mem. Inst. Butantan S. Paulo* **10**: 19.

Cyclolaelaps Ewing 1933, *Proc. U.S. nat. Mus.* **82** (art. 30): 5.

Turkiella Zumpt & Till, 1953, *An. Inst. Med. trop. Lisboa* **10**: 215.

Zygoaelaps Tipton, 1957, *J. Parasit.* **43**: 367.

Type: *Laelaps (Iphis) hermaphrodita* Berlese, 1887.

Medium sclerotized mites ranging from about $400\ \mu$ to $1,600\ \mu$ in length. Chelicerae usually chelate-dentate in the female with the movable digit bidentate; occasionally this digit is edentate except for a terminal hook, and may have an additional cutting process with outwardly directed teeth. Fixed digit in the male markedly reduced, edentate; movable digit usually edentate and partially fused with the elongated, grooved spermadactyl. Dorsal seta and fissures normal. Arthrodial

processes present at base of movable digit. Chaetotaxy of venter of gnathosoma and pedipalps normal, apotele two-tined. Deutosternum with 6 rows of denticles, each row with from one to six denticles. Corniculi usually horn-like, occasionally reduced; internal malae fringed or fimbriated. Tectum capituli membranous, rounded anteriorly, never denticulate.

Dorsal shield entire, usually with the basic 39 pairs of simple or barbed setae. This number may be increased by the addition of a pair of setae on the podonotal region (anterior accessory—*ax*) and/or a pair of setae (posterior accessory—*px*) on the opisthonotal region, giving patterns with 40 and 41 pairs of setae respectively. There may also be varying degrees of hypertrichy ranging from a few accessory setae between the *J* series to a dense covering of setae which completely obscures the basic pattern. The basic number of setae may be reduced by the absence of *z3* or the *px* series, or one or more pairs of marginal setae may be situated on the unsclerotized integument.

Tritosternum normal, bipartite. No definite pre-endopodal shields. Sternal shield in the female with three pairs of setae and two pairs of pores. Genital shield narrow or variously inflated, bearing one pair of setae. Anal shield pear-shaped or subtriangular with normal setation. Opisthogastric cuticle with variable number of setae. Peritrematal shields free posteriorly. Metapodal shields present. Male usually with holovenral shield not fused with peritrematal shield; bearing from seven to ten pairs of setae, excluding the anals. A few species have a sternito-genito-ventral shield and a separate anal shield. Podal shields poorly developed posterior to coxae IV.

Chaetotaxy of legs normal except genu IV which has two postero-laterals ($2-\frac{2}{1}$, $\frac{3}{0}-2$). In some ethiopian species deviant patterns are found on tibia I ($2-\frac{3}{2}$, $\frac{3}{2}-2$), genu III ($2-\frac{2}{1}$, $\frac{2}{1}-2$) and tibia III ($2-\frac{1}{1}$, $\frac{2}{1}-2$) and in one species genu IV is normal. Seta *av*₁ on femur II may be modified to form a stout, spur-like structure in both sexes, or in the male only, of certain species. Ambulacra of all legs with paired claws. Coxa II has a small anterior spine.

KEY TO MALES AND FEMALES

- 1 Both sexes with pilus dentilis inflated basally, distal portion slender, curved (Text-fig. 12B). Greatest width of genital shield in female at the level of the first pair (*Zv*₁) of opisthogastric setae (Text-fig. 12C) ***A. fahrenheitzi*** (Berlese) (p. 156)
- Both sexes with pilus dentilis slender, setiform (Text-fig. 10D). Greatest width of genital shield in female approximately at level of second pair (*Jv*₁) of opisthogastric setae (Text-fig. 10B) ***A. casalis*** (Berlese) s. lat.
- 2 Dorsal shield 620 μ –710 μ long in female, 466 μ –485 μ long in male; seta *Z*₅ slender, setiform, about one and one-half times as long as *J*₅ (Text-fig. 11B). Associated with birds and rodents ***A. casalis*** s. str. (p. 152)
- Dorsal shield 504 μ long in female, 402 μ long in male; seta *Z*₅ stout, subspiniiform, scarcely longer than *J*₅ (Text-fig. 11C). Associated with ants
A. casalis myrmecophila ssp. nov. (p. 154)

Androlaelaps casalis casalis (Berlese)

?*Gamasus fenilis* Mégnin, 1876¹, *J. Anat. Physiol. Paris* **12**: 332.

Iphis casalis Berlese, 1887, *Acari, Myr. Scorp. Ital fasc.* 38, no. 8, figs. 3-5.

Androlaelaps casalis: Till, 1963, *Bull. Brit. Mus. (nat. Hist.) Zool.* **10**: 23, figs. 6-9, 25-29.

Hypoaspis oculatus Oudemans, 1915, *Arch. Naturgesch. (A)* **81**: 134.

Hypoaspis soarianus Hull, 1925, *Ann. Mag. nat. Hist. (9)*, **15**: 209 (**syn. nov.**).

Haemolaelaps molestus Oudemans, 1929, *Ent. Ber. Amst.* **8**: 13.

Atricholaelaps megaventralis Strandtmann, 1947, *Proc. ent. Soc. Wash.* **49**: 112.

Hypoaspis freemani Hughes, 1948, *Mites associated with stored food products*: 129, figs. 173-179.

Haemolaelaps haemorrhagicus Asanuma, 1952, *Misc. Rep. Res. Inst. Nat. Res.* no. 25: 87, fig. 1.

Female: Chelicera with segment I, 63 μ ; II, 108 μ ; movable digit 36 μ , bidentate; fixed digit with two or three teeth; pilus dentilis slender, setiform (Text-fig. 10D). Four pairs of gnathosomal setae with c.s. about 60 μ apart; *hyp*.2 about 42 μ apart. Deutosternum with six transverse rows of denticles (2-6 per row). Corniculi 36 μ long, internal malae fringed. Tectum capituli with smooth anterior margin. Salivary styli conspicuous, not reaching tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (620-710 $\mu \times$ 376-429 μ) with the normal 39 pairs of simple setae and a variable number of unpaired accessory setae distributed as in Text-fig. 10A. Surface of shield reticulate; two pairs of *r* and seven pairs of *R* setae on the cuticle.

Tritosternum with base 54 μ , laciniae 80 μ . Sternal shield (100 $\mu \times$ 126 μ) with three pairs of setae and two pairs of pores; metasternal setae free with associated pores. Between *st*1, 80 μ ; between *st*1 and *st*3, 96 μ . Genital shield (177 $\mu \times$ 105 μ) flask-shaped with one pair of setae. Anal shield (90 $\mu \times$ 102 μ) with par- and post-anal setae about 42 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 10B. Peritreme extends to middle of coxa I; peritrematal shield free posteriorly; anterior tip almost touches, but is not fused with, dorsal shield.

Chaetotaxy of legs differs from normal pattern in having two posterolateral setae on genu IV. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	87/38	72/45	54/36	78/33
tibia	90/33	70/42	57/33	80/33
tarsus	147/30	120/30	120/30	162/27

Male: Chelicera with segment I, 40 μ ; II, 75 μ ; movable digit 40 μ , 54 μ with spermadactyl; both digits edentate (Text-fig. 10E). Four pairs of gnathosomal setae with c.s. about 48 μ apart; *hyp*.2 about 33 μ apart. Corniculi 27 μ long; deutosternum, internal malae, tectum and pedipalps as in female.

Dorsal shield (466-485 $\mu \times$ 276-322 μ) with the usual 39 pairs of setae and three unpaired accessory setae. Surface of shield reticulated.

Tritosternum with base 33 μ , laciniae 66 μ . Holoventral shield (384 $\mu \times$ 95 μ) with four pairs of setae and three pairs of pores in the sternal region, six pairs of setae

¹ It is not possible to be certain of the identity of this species from its short and inadequate original description.

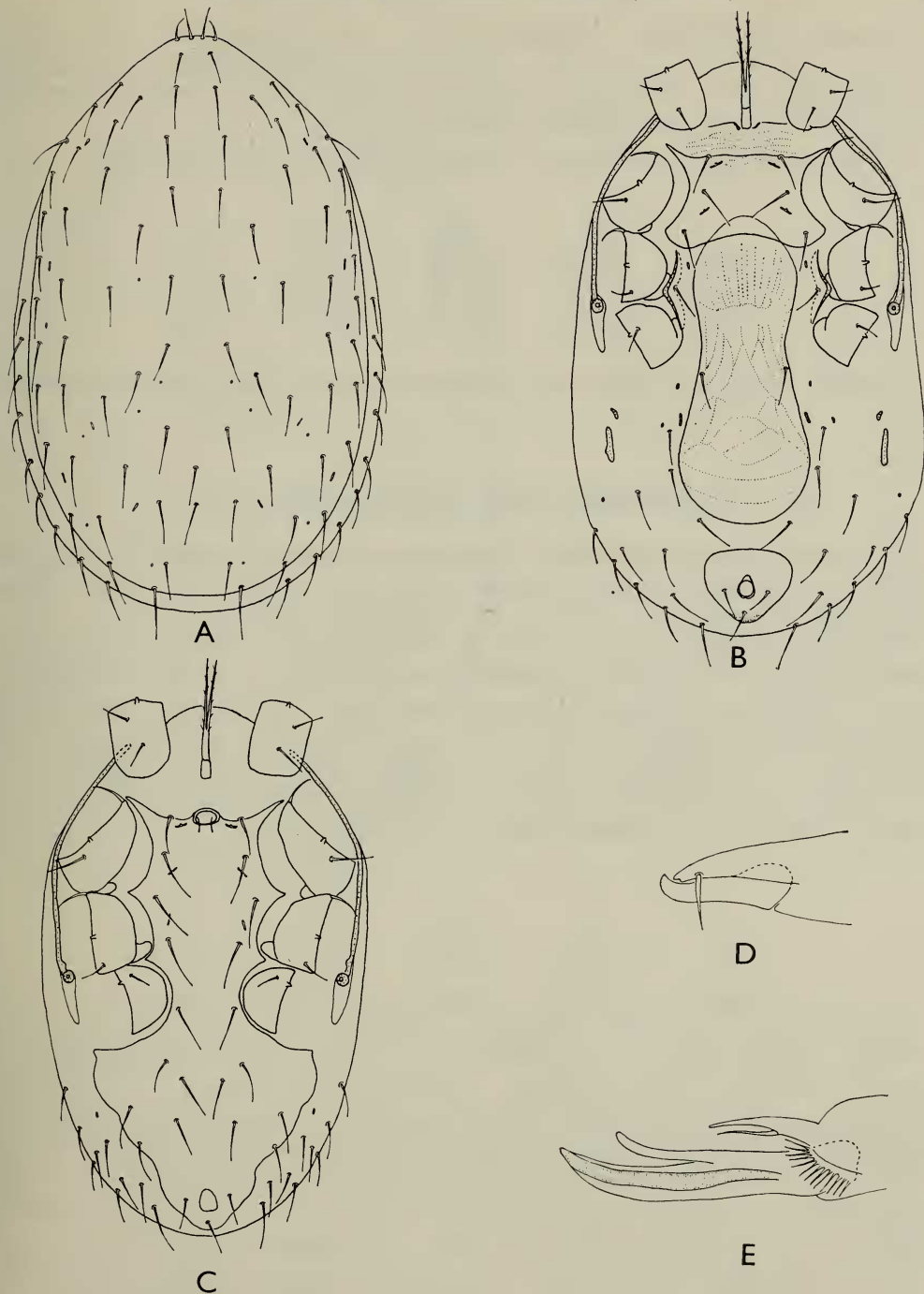


FIG. 10. *Androlaelaps casalis casalis* (Berlese). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. venter of idiosoma of male; D. chelicera of female; E. chelicera of male.

in the genito-ventral region. Between *st*1, 60 μ ; between *st*1 and *st*3, 80 μ . Paranal setae 18 μ , postanal seta 27 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 10c. Peritreme extends to middle of coxa I; peritrematal shield fused anteriorly with dorsal shield, posterior part free.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	72/36	70/45	50/33	70/33
tibia	78/30	60/40	50/30	72/30
tarsus	120/28	87/30	87/27	130/24

HABITAT : Cosmopolitan, in the nests of birds, in poultry litter and also on rodents.

Androlaelaps casalis myrmecophila ssp. nov.

In all instars this subspecies closely resembles *Androlaelaps casalis* s. str. from which it differs in certain of its measurements and in having setae *Z*5 at the posterior margin of the dorsal shield relatively short and stout (Text-fig. 11c).

Female : Dorsal shield (504 $\mu \times$ 288 μ) with the usual 39 pairs of setae and two to three unpaired accessory setae distributed as in Text-fig. 11A. Sternal shield (80 $\mu \times$ 105 μ) not sharply demarkated from pre-sternal area. Between *st*1, 72 μ ; between *st*1 and *st*3, 78 μ . Genital shield (140 $\mu \times$ 84 μ) with genital setae only. Anal shield (72 $\mu \times$ 72 μ) with par- and postanal setae subequal, about 30 μ long.

Chaetotaxy of legs as in *A. casalis* s. str. Tibia and tarsus II with relatively stout, spinose, ventral setae. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	70/32	54/36	42/27	63/27
tibia	75/27	50/36	45/27	66/27
tarsus	130/26	84/24	90/22	120/22

Male : Gnathosoma as in *A. casalis* s. str. Dorsal shield (402 $\mu \times$ 222 μ) with chaetotaxy and setal form as in female. Holoventral shield (324 $\mu \times$ 90 μ) expanded behind coxae IV, with ten pairs of setae excluding the anals. Between *st*1, 57 μ ; between *st*1 and *st*3, 66 μ . Par- and postanal setae about 20 μ long.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	66/30	54/36	38/27	60/27
tibia	60/26	48/33	40/26	60/26
tarsus	110/24	75/24	75/21	108/21

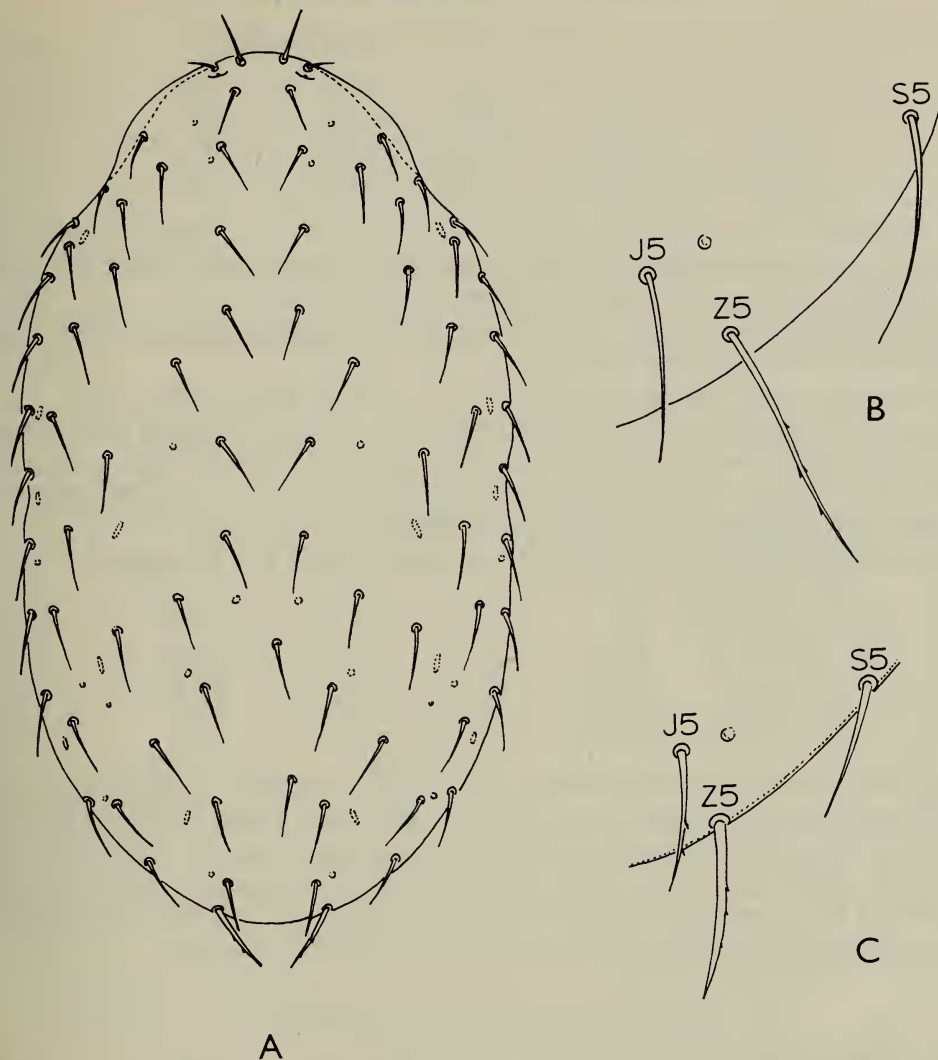


FIG. 11. A. *Androlaelaps casalis myrmecophila* ssp. nov.; dorsum of idiosoma of female.
B-C. Relative lengths of dorsal setae J5, Z5, and S5 of *A. casalis casalis* (B) and *A. casalis myrmecophila* (C).

Protonymph: Chelicera with segment I, $36\ \mu$; II, $66\ \mu$; movable digit $22\ \mu$. Four pairs of gnathosomal setae with c.s. about $45\ \mu$ apart, *hyp.2* about $33\ \mu$ apart. Corniculi $27\ \mu$ long; pedipalp (1-4-5-12) with two-tined apotele.

Podonotal shield ($210\ \mu \times 186\ \mu$) with eleven pairs of setae; pygidial shield ($96\ \mu \times 156\ \mu$) with eight pairs of setae; mesonotal region with four pairs of scutellae.

Tritosternum with base $40\ \mu$, laciniae $54\ \mu$. Sternal shield (about $144\ \mu \times 93\ \mu$) with anterior margin indistinct. Between *st1*, $63\ \mu$; between *st1* and *st3*, $102\ \mu$. Anal shield ($48\ \mu \times 60\ \mu$) with par- and postanal setae about $24\ \mu$ long. Peritreme extends to middle of coxa III.

Chaetotaxy of legs normal. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	54/33	45/36	33/27	45/28
tibia	54/30	42/33	33/27	48/27
tarsus	93/26	63/24	69/24	93/22

Deutonymph : Chelicera with segment I, 40 μ ; II, 68–70 μ ; movable digit 21 μ . Four pairs of gnathosomal setae with c.s. about 42 μ apart, *hyp*.2 about 30 μ apart. Corniculi 24 μ long ; other gnathosomal features as in female.

Dorsal shield (348 μ $\times$ 198 μ) with lateral incisions and bearing the usual 39 pairs of setae and two or three accessories.

Tritosternum with base 40 μ , laciniae 54 μ . Sternal shield (about 174 μ $\times$ 72 μ) with anterior margin indistinct ; bearing four pairs of setae and three pairs of pores. Between *st*1, 54 μ ; between *st*1 and *st*3, 78 μ . Anal shield (48 μ $\times$ 45 μ ; maximum width 60 μ) ; par- and postanal setae about 20 μ long. Peritreme extends to posterior third of coxa I ; peritrematal shield weakly developed.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	54/30	45/34	30/27	48/27
tibia	57/26	42/30	33/24	48/24
tarsus	96/24	66/24	70/21	93/21

HABITAT : From the nests of *Formica rufa* Linn. Holotype ♀ (1965 : 12 : 29 : 7) and female paratype (1965 : 12 : 29 : 8) from the Black Wood of Rannoch, Perthshire (coll. R. M. Emberson, 13 April 1964) ; male allotype (1965 : 12 : 29 : 9), male and female paratypes (1965 : 12 : 29 : 10), protonymph and deutonymph from Ufton Park, Berkshire (coll. C. A. Collingwood). The specimens are deposited in the collection of the British Museum (Natural History), London.

Androlaelaps fahrenheitzi (Berlese)

Laelaps (*Haemolaelaps*) *fahrenheitzi* Berlese, 1911, *Redia* **7** : 432.

Liponyssus setiger Ewing, 1920, *Ent. News* **31** : 290, figs. 6–7.

Laelaps glasgowi Ewing, 1925, *Proc. ent. Soc. Wash.* **27** : 6.

Androlaelaps glasgowi : Till, 1963, *Bull. Brit. Mus. (nat. Hist.) Zool.* **10** : 40, figs. 65–68.

Laelaps californicus Ewing, 1925, *Proc. ent. Soc. Wash.* **27** : 5.

Laelaps virginianus Ewing, 1925, *Proc. ent. Soc. Wash.* **27** : 6.

Hypoaspis microti Oudemans, 1926, *Ent. Ber. Amst.* **7** : 101.

Haemolaelaps mohrae Oudemans, 1928, *Ent. Ber. Amst.* **7** : 374.

Haemolaelaps cricetophilus Vitzthum, 1930, *Zool. Jb. Jena, Abt. Syst.* **60** : 417.

Laelaps stegemani Hefley, 1935, *J. Kansas ent. Soc.* **8** : 22.

Ischnolaelaps rhabdomys Radford, 1939, *Parasitology* **31** : 249.

Haemolaelaps scalopi Keegan, 1946, *Trans. Amer. Micr. Soc.* **65** : 71.

Atricholaelaps sigmodoni Strandtmann, 1946, *J. Parasit.* **32** : 164.

Atricholaelaps strandtmanni Fox, 1947, *Ann. ent. Soc. Amer.* **40** : 580.

Hypoaspis (*Haemolaelaps*) *eos* Zumpt & Patterson, 1951, *J. ent. Soc. S. Afr.* **14** : 79.

Female : Chelicera with segment I, $72\ \mu$; II, $126\ \mu$; movable digit $36\ \mu$, bidentate ; fixed digit bidentate ; pilus dentilis inflated basally, distal portion slender, curved (Text-fig. 12B). Four pairs of gnathosomal setae with *c.s.* about $72\ \mu$ apart ; *hyp.2* about $54\ \mu$ apart. Deutosternum with six transverse rows of denticles (3–5 per row) ; corniculi $30\ \mu$ long ; internal malae fringed. Tectum capituli with smooth anterior margin. Salivary styli slender, extending to tips of corniculi. Pedipalp (2–5–6–14) with two-tined apotele.

Dorsal shield ($714\ \mu \times 432\ \mu$) with the normal 39 pairs of setae distributed as in Text-fig. 12A ; some anterior setae barbed. Surface of shield reticulated ; no hypertrichy in British specimens ; with two pairs of *r* and seven pairs of *R* setae on the cuticle.

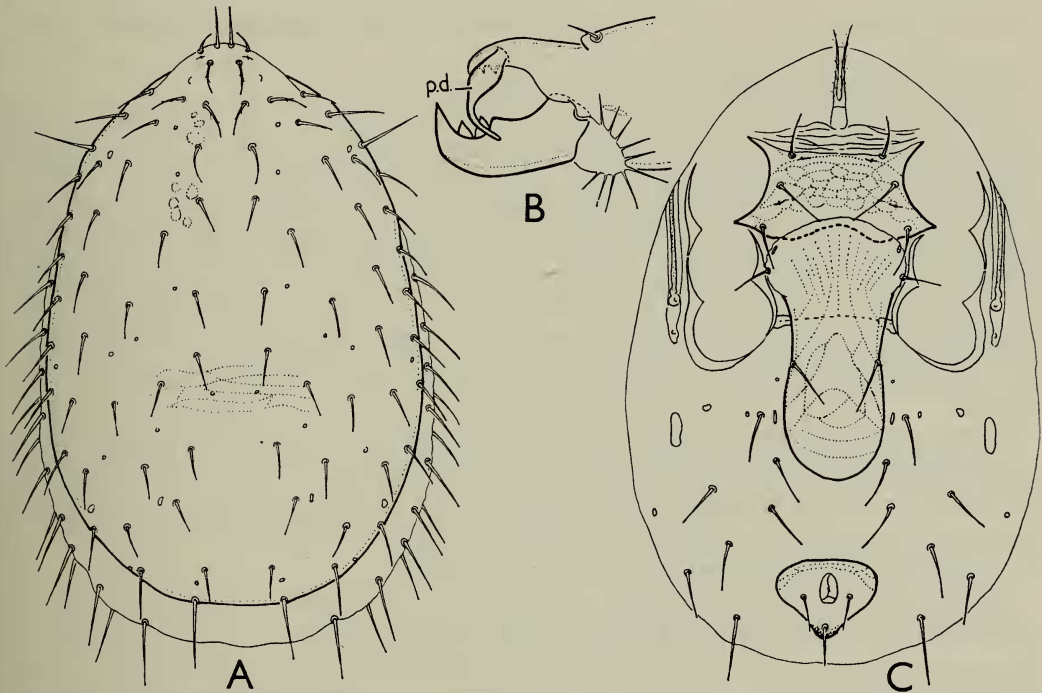


FIG. 12. *Androlaelaps fahrenheitsi* (Berlese), female ; dorsum of idiosoma (A) ; chelicera (B) ; venter of idiosoma (C).

Tritosternum with base $45\ \mu$, laciniae $135\ \mu$. Sternal shield ($96\ \mu \times 168\ \mu$) with three pairs of setae and two pairs of pores. Metasternals free with associated pores. Between *st1*, $96\ \mu$; between *st1* and *st3*, $102\ \mu$. Genital shield tongue-shaped ($156\ \mu \times 114\ \mu$), with genital setae only. Anal shield ($90\ \mu \times 112\ \mu$) with paranal setae $54\ \mu$, postanal seta $66\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 12C. Peritreme extends to middle of coxa I ; peritrematal shield fused anteriorly with dorsal shield, posterior part free.

Chaetotaxy of legs differs from normal pattern in having two postero-lateral setae on genu IV. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	96/45	90/60	70/45	105/45
tibia	93/36	80/57	70/42	110/42
tarsus	162/36	126/42	144/36	240/36

Male: Described and figured by Till (1963).

HABITAT: Cosmopolitan, chiefly on rodents and in their nests. Also recorded from birds, bats and small carnivores.

Genus *HYPOASPIS* Canestrini

Hypoaspis Canestrini, 1884, *Atti. Ist. Veneto* (6) **2**: 1569; 1885, *Acarofauna ital.* part 1: 55.

Type: *Gamasus krameri* Canestrini, 1881.

Chelicerae typically chelate-dentate with the movable digit bidentate in the female, rarely digits edentate or specialized for egg-feeding in certain myrmecophilous forms. Pilus dentilis normally short, setiform; dorsal seta and fissures present. Chelicerae of male chelate, movable digit usually unidentate, spermadactyl free, distally grooved and never completely fused with the movable digit. Arthrodial processes simple, rarely absent. Chaetotaxy of the venter of the gnathosoma and of the pedipalps normal, apotele two or three-tined, the latter with subequal tines. Deutosternum with six, rarely five, transverse rows of denticles. Corniculi horn-like, salivary styli present. Tectum capituli with anterior margin smooth or denticulate.

Entire dorsal shield typically with 39 pairs of setae, px_2 and px_3 being present. Variations in the basic pattern are the result of absence of px_2 and px_3 (37 pairs), r_2 and r_4 on lateral integument (37 pairs), z_3 and r_1 absent (37 pairs), presence of extra r seta (40 pairs) or extra r seta and px (41 pairs). Unpaired accessory setae in the region of the J series may be present or absent.

Tritosternum normal, bipartite. Pre-endopodal shields occasionally present. Sternal shield in the female usually with three pairs of setae and two pairs of pores; first pair of setae may be placed on the pre-sternal area (*Cosmolaelaps* group). Genital shield flask-shaped with one pair of setae, or, genito-ventral shield variously inflated and bearing one to three pairs of opisthogastric setae situated on its lateral margins. Anal shield usually pear-shaped or subtriangular, with normal chaetotaxy. Opisthogastric cuticle with variable number of setae. Peritrematal shields free posteriorly or fused with podal shields. Metapodal shields present. Male usually with holovenral shield which may or may not be fused with the peritrematal shields, and which bears 9 or 10 pairs of setae excluding the anals. Anal shield occasionally free. Podal shields poorly or well developed posterior to coxae IV.

Chaetotaxy of legs usually normal. Variations result from addition of seta pl_2 on tibia III ($2-\frac{1}{1}$, $\frac{2}{1}-2$), seta pl_2 or pv on genu IV ($2-\frac{2}{1}$, $\frac{3}{0}-2$ or $2-\frac{2}{1}$, $\frac{3}{1}-1$) and the absence of al_2 on genu IV ($1-\frac{2}{1}$, $\frac{3}{0}-1$). Anterior spine on coxa II small or absent. Ambulacra usually with paired claws; claws on leg I occasionally reduced

or absent. A ventral seta on femur II in the male, or both sexes, sometimes enlarged and spine-like.

The present classification of the *Hypoaspis* complex is largely based on palaearctic forms and requires radical revision. It appears to be well represented in the nearctic, tropical and subtropical regions and we feel that a knowledge of the extra-palaearctic forms is an essential prerequisite to any attempt at a "generic" classification of the complex. According to the current classification of *Hypoaspis*, the majority of the British species may be distributed among the following of its subgenera:

HYPOASPIS s. str. (type: *Gamasus krameri* G. & R. Canestrini, 1881).

H. krameri (Canestrini).

ALLOPARASITUS Berlese, 1920 (type: *Laelaps (Hypoaspis) oblongus* Halbt., 1915) syn: *Halbertia*, Hull in Turk & Turk, 1952.

H. oblonga (Halbt.).

COSMOLAELAPS Berlese, 1903 (type: *Laelaps claviger* Berlese, 1883).

H. claviger (Berlese); *H. cuneifer* (Michael); *H. vacua* (Michael); *H. neo-cuneifer* sp. nov.

GAEOLAELAPS Trägårdh, 1952 (type: *Laelaps aculeifer* Canestrini, 1884).

H. aculeifer (Canestrini); *H. giffordi* sp. nov.; *H. lubrica* Voigts & Oudemans; *H. praesternalis* Willmann and (?) *H. sardoa* Berlese.

GYMNOLAELAPS Berlese, 1903 (type: *Laelaps myrmecophilus* Berlese, 1892).

H. myrmecophila (Berlese); *H. laevis* (Michael) and

H. myrmophila (Michael).

HOLOSTASPIS Kolenati, 1858 (type: *Holostaspis isotricha* Kolenati, 1858).

H. isotricha Kolenati; *H. montana* (Berlese) and *H. oophila* (Wasman).

LAELASPIS Berlese, 1903 (type: *Iphis astronomicus* Koch, 1839).

H. astronomica (Koch); *H. humerata* (Berlese) and *H. equitans* (Michael).

PNEUMOLAELAPS Berlese, 1920 (type: *Iphis bombicolens* Canestrini, 1885).

H. bombicolens (Canestrini); *H. marginalis* Willmann;

H. breviseta sp. nov.; *H. colomboi* sp. nov.; *H. hyatti* sp. nov. and *H. minutissima* sp. nov.

STRATIOLAELAPS Berlese, 1916 (type: *Laelaps (Iphis) miles* Berlese, 1882).

syn. *Davisiella* Zumpt & Patterson, 1951 (**syn. nov.**)

H. miles (Berlese).

Hypoaspis heselhausi Oudms. and *H. nidicorva* sp. nov., and *H. acuta* (Michael) appear to represent distinct species-groups.

There is little doubt that certain of these subgenera represent natural bio-morphological groups, although the boundaries between them cannot be satisfactorily defined on the basis of their morphological characteristics alone, even in such apparently distinct groups as *Pneumolaelaps*, *Holostaspis* and *Gymnolaelaps*.⁵ In view of this we are disregarding the subgeneric divisions in the following key to the British species of the complex.

⁵ There are, at present, no comprehensive definitions or keys to the subgenera of *Hypoaspis*. The placing of species within the subgenera has largely been by rule of thumb, generally following Berlese's (1903) concepts. The following key, based on eco-morphological characteristics provides a guide to the subgenera or species-groups represented in the British fauna.

KEY TO FEMALES

- 1 Genu IV with eight setae, an antero-lateral seta lacking ($1-\frac{2}{1}, \frac{3}{0}-1$); peritrematal shields free posteriorly and extending well beyond posterior margins of coxae IV (Text-fig. 46F) ***H. oblonga*** (Halbt.) (p. 222)
- Genu IV with 9 or 10 setae, two antero-lateral setae present ($2-\frac{2}{1}, \frac{3}{0}-1$; $2-\frac{2}{1}, \frac{3}{1}-1$ or $2-\frac{2}{1}, \frac{3}{0}-2$); peritrematal shield not extending posterior to coxae IV, free or fused with the podal shields 2
- 2 Dorsal shield lacking setae *px* on the opisthonotal region and never with unpaired accessory setae; dorsal setae leaf-like, spatulate (Text-fig. 45A); corniculi long, slender, extending almost to the level of the anterior margin of the palpfemur ***H. miles*** (Berlese) (p. 222)
- Dorsal shield with setae *px* present, with or without unpaired accessory setae; dorsal setae various; corniculi relatively shorter, if reaching beyond the level of the middle of the palpfemur then dorsal setae simple 3

(Footnote continued from p. 159)

- 1 Genu IV with eight setae ($1-\frac{2}{1}, \frac{3}{0}-1$); peritrematal shield in the female free posteriorly and extending well beyond the posterior margins of coxae IV (Text-fig. 46F) ***Alloparasitus*** Berlese
- Genu IV with nine or ten setae; peritrematal shield in the female not extending posterior to coxae IV, free or fused with podal shields 2
- 2 Dorsal shield lacking setae *px* in the opisthonotal region and never with unpaired accessory setae; dorsal setae leaf-like, spatulate. Corniculi long, slender, extending almost to the level of the anterior margin of the palpfemur ***Stratiolaelaps*** Berlese
- Dorsal shield with setae *px* present, with or without unpaired accessories; dorsal setae various. Corniculi relatively shorter, if reaching to the middle of the palpfemur then dorsal setae simple 3
- 3 Dorsal setae spatulate, cuneiform or scimitar-like. Free-living or myrmecophilous ***Cosmolaelaps*** Berlese
- Dorsal setae simple or pilose, never markedly flattened 4
- 4 Certain setae of the dorsum and of the segments of the legs (femur II, femur and tarsus IV) long and whip-like. Associated with Coleoptera ***Hypoaspis*** s. str.
- Setae of the dorsum rarely, and legs never, long and whip-like 5
- 5 Genu IV with two ventral setae ($2-\frac{2}{1}, \frac{3}{1}-1$); peritremes usually broad; lateral and ventral cuticle often densely setose. In nests of *Bombus* ***Pneumolaelaps*** Berlese
- Genu IV with one ventral seta ($2-\frac{2}{1}, \frac{3}{0}-1/2$), if with two ventral setae, then peritremes narrow 6
- 6 Apotele with three subequal tines. Discrete, well-sclerotized pre-endopodal shields present; dorsal shield with 40-41 pairs of setae (excluding unpaired accessories). Myrmecophilous ***Gymnolaelaps*** Berlese
- Apotele two-tined. Usually without discrete pre-endopodal shields; dorsal shield with not more than 39 pairs of setae (excluding unpaired accessories) 7
- 7 Digits of the chelicerae in the female stumpy, dentate or edentate and modified for oophagy, movable digit about 20 μ in length. Myrmecophilous ***Holostaspis*** Kolenati
- Digits of the chelicerae in the female normal in form, dentate or edentate; movable digit at least 35 μ in length 8
- 8 Genito-ventral shield in the female markedly inflated posterior to coxae IV, flanked by linear metapodals and characteristically ornamented. Dorsal setae long, whip-like, or marginal setae serrated. Myrmecophilous or free-living ***Laelaspis*** Berlese
- Genital or genito-ventral shield otherwise; dorsal setae never long or whip-like. Free-living or inhabitants of nests of birds and mammals ***Gaeolaelaps*** Trägårdh (including *heselhausi-nidicorva* group)

- 3 Dorsal setae j_2 -3, z_2 -4, S_4 -5 and Z_4 considerably longer than other dorsal setae, Z_4 very long and whip-like (Text-fig. 13A) ; seta pd_1 on femur II, ad_1 on femur IV, ad_{2-3} and pd_2 on tarsus IV long and whip-like. Associated with *Lucanus* (Coleoptera) ***H. krameri*** (Canestrini) (p. 163)
- Dorsal chaetotaxy otherwise ; leg setae never long and whip-like 4
- 4 Dorsal setae spatulate (Text-fig. 24c), cuneiform (Text-fig. 25c) or scimitar-like (Text-fig. 28A-c) 5
- Dorsal setae simple or pilose, never markedly flattened 8
- 5 Majority of dorsal setae cuneiform (Text-fig. 25c) 6
- Majority of dorsal setae spatulate or scimitar-like 7
- 6 Genu IV with two postero-lateral setae ($2-\frac{2}{1}, \frac{3}{0}-2$) ; dorsal seta S_2 clavate, considerably shorter than cuneiform seta S_1 (Text-fig. 25A) ; proximal region of cuneiform seta only slightly enlarged (Text-fig. 25c) ***H. cuneifer*** (Michael) (p. 184)
- Genu IV with one postero-lateral seta ($2-\frac{2}{1}, \frac{3}{0}-1$) ; dorsal setae S_1 -2 cuneiform, subequal (Text-fig. 26A) ; proximal region of cuneiform seta conspicuously enlarged (Text-fig. 26D) ***H. neocuneifer*** sp. nov. (p. 187)
- 7 Dorsal setae spatulate, clavate (Text-fig. 24c) ; peritremes extending to the level of the vertical setae (j_1) ; sternal shield with strong reticulate pattern (Text-fig. 24D) ***H. claviger*** (Berlese) (p. 182)
- Dorsal setae scimitar-like (Text-fig. 28A-c) ; peritremes extending to the level of the middle of coxae I ; sternal shield without conspicuous ornamentation (Text-fig. 27B) ***H. vacua*** (Michael) (p. 190)
- 8 Genu IV with two ventral setae, pv present ($2-\frac{2}{1}, \frac{3}{1}-1$) 9
- Genu IV with one ventral seta, pv absent ($2-\frac{2}{1}, \frac{3}{0}-1$ or $2-\frac{2}{1}, \frac{3}{0}-2$) 16
- 9 Capitular setae and setae on coxae I-II stout, spinelike. Associated with *Bombus* (Hymenoptera) ***H. fuscicolens*** (Oudemans) (p. 196)
- Capitular setae and setae on coxae I-II slender, normal 10
- 10 Dorsal shield shows hypertrichy between the J series ; surface of shield with a clearly defined reticulate pattern 11
- Dorsal shield without hypertichy between the J series ; surface of shield with or without a distinct reticulate pattern 14
- 11 Sternal shield distinctly wider than long ($L/W = 0.7$) ; deutosternum with six rows each consisting of 2-8 unequally sized denticles. 12
- Sternal shield about as wide as long ($L/W = 1.0$) or longer than wide ($L/W = 1.1$) ; deutosternum with six rows each of at least six small, uniform, denticles. 13
- 12 Opisthogaster densely setose, region between genital and anal shields with about twenty setae (Text-fig. 34B) ; ratio of distance between genital setae to the maximum width of the genital shield about 1.15 ***H. marginalis*** (Willmann) (p. 199)
- Opisthogaster not densely setose, region between genital and anal shields with four setae (Text-fig. 33B) ; ratio of distance between genital setae to maximum width of genital shield about 1.3 ***H. hyatti*** sp. nov. (p. 198)
- 13 Dorsal shield about 700μ in length ; setae j_2 extending at least three-quarters of the distance between j_2 and j_3 ; setae on distal third of tarsus II distinctly thickened, spine-like. Associated with nests of birds and small mammals ***H. lubrica*** Voigts & Oudemans (p. 172)
- Dorsal shield about 500μ in length ; setae j_2 extending to about one-half the distance between j_2 and j_3 ; setae on distal third of tarsus II not distinctly thickened nor spine-like. Associated with *Bombus* ***H. minutissima*** sp. nov. (p. 201)
- 14 Sternal shield longer than wide ($L/W = 1.1$). Opisthogastric setae subequal in length. Peritreme relatively narrow ; length of posterior part of peritrematal shield at least three times the width of the peritreme (Text-fig. 31B) ***H. colomboi*** sp. nov. (p. 194)

- Sternal shield wider than long ($L/W = 0.6$). Opisthogastric setae flanking genital shield about twice as long as those near the margin of the body. Peritreme relatively wide; length of posterior part of peritrematal shield not more than twice the width of the peritreme 15
- 15 Setae on anterior part of dorsal shield relatively long; seta j_3 reaches base of seta j_4 (Text-fig. 29A); surface of shield with distinct reticulate pattern in addition to sculptured areas for muscle attachment *H. bombicolens* (Canestrini) (p. 191)
- Setae on anterior part of dorsal shield relatively short; seta j_3 extends about half-way to base of seta j_4 ; surface of shield without a distinct reticulate pattern *H. breviseta* sp. nov. (p. 193)
- 16 Genu IV with two postero-lateral setae ($2-\frac{2}{1}, \frac{3}{0}-2$) (Text-fig. 44C) 17
- Genu IV with one postero-lateral seta ($2-\frac{2}{1}, \frac{3}{0}-1$) (Text-fig. 44B) 19
- 17 Antero-ventral seta on femur II and genu II stout and spine-like (Text-fig. 20D); tibia III with two postero-lateral setae ($2-\frac{1}{1}, \frac{2}{1}-2$); dorsal shield with 39 pairs of setae (Text-fig. 20A) *H. sardoa* Berlese (p. 175)
- Antero-ventral seta on femur II and genu II not conspicuously thickened; tibia III with one postero-lateral seta ($2-\frac{1}{1}, \frac{2}{1}-1$); dorsal shield with 37 or 41 pairs of setae. Myrmecophilous 18
- 18 Dorsal shield about $1,100 \mu$ in length with 41 pairs of short, fine, dorsal setae (Text-fig. 43D); apotele with three subequal tines *H. laevis* (Michael) (p. 220) -
- Dorsal shield about 700μ in length with 37 pairs of medium, relatively stout, dorsal setae (Text-fig. 41A); apotele with two subequal tines *H. acuta* (Michael) (p. 212) -
- 19 Peritrematal shield fused with the expodal shield in the region of coxa IV. 20
- Peritrematal shield free posteriorly 21
- 20 Dorsal setae short, setae J_1 reaching about mid-way between the bases of J_1 and J_2 (Text-fig. 21A); genito-ventral shield sub-rectangular in outline (Text-fig. 21D) with a pair of setae lying between the genito-ventral and anal shields *H. heselhausi* (Oudemans) (p. 177)
- Dorsal setae long, seta J_1 reaching beyond the bases of J_2 by about one-half their length (Text-fig. 22A); genito-ventral shield flask-shaped (Text-fig. 22B), without setae between the genito-ventral and anal shields *H. nidicorva* sp. nov. (p. 179)
- 21 Apotele with three subequal tines (Text-fig. 42C) 22
- Apotele with two subequal tines. 23
- 22 Larger species, over $1,000 \mu$; sternal shield with $L/W = 0.8$; genito-ventral shield as in Text-fig. 42B *H. myrmecophila* (Berlese) (p. 214)
- Smaller species, about 700μ ; sternal shield almost twice as broad as long ($L/W = 0.5$); genito-ventral shield as in Text-fig. 43B *H. myrmophila* (Michael) (p. 218)
- 23 Dorsum with only one pair of setae in the *R* series (Text-fig. 19A); peritreme extending to about the middle of coxa II (Text-fig. 19E); Small species about 500μ in length *H. praesternalis* Willmann (p. 173)
- Dorsum with five or more pairs of setae in the *R* series; peritreme extending up to or beyond coxa I 24
- 24 Majority of dorsal and opisthogastric setae very long, sinuous (Text-figs. 40A and E); setae J_3 extending beyond the bases of setae J_4 by at least a quarter of their length. Myrmecophilous 25
- Dorsal and opisthogastric setae normal in length; setae J_3 never reach the bases of J_4 26
- 25 Legs relatively short and stumpy; leg IV (trochanter to tarsus) about one-half the length of the dorsal shield; movable digit of the chelicera strongly bidentate (Text-fig. 40D) *H. humerata* Berlese (p. 212)
- Legs relatively long and slender; leg IV (trochanter to tarsus) scarcely shorter than the dorsal shield; movable digit of chelicera edentate (Text-fig. 40B) *H. equitans* (Michael) (p. 210)

- 26 Femur II with antero-ventral seta stout, spine-like ; tarsus IV with long, stout, spine-like setae ; genital shield small **H. aculeifer** (Canestrini) (p. 166)
- Femur II with antero-ventral seta simple, not conspicuously thickened ; tarsus IV without long spine-like setae. 27
- 27 Cheliceral digits normal, slender ; movable digit longer than the palpfemur and strongly bidentate 28
- Cheliceral digits atypical, stumpy ; movable digit shorter than the palpfemur, weakly dentate or edentate 29
- 28 Genito-ventral shield greatly expanded posterior to coxae IV ; metapodal shields flanking genito-ventral shield ; marginal setae of dorsal shield strong, serrated **H. astronomica** (Koch) (p. 208)
- Genital shield relatively narrow posterior to coxae IV ; metapodal shields widely removed from its margins (Text-fig. 17E) ; dorsal setae simple **H. giffordi** sp. nov. (p. 170)
- 29 Dorsal setae of the *J* series markedly unequal in length ; setae *J*₄ and *J*₅ pilose distally and considerably longer and stouter than simple setae *J*₁–*J*₃ (Text-fig. 38A). Myrmecophilous **H. oophila** (Wasman) (p. 207)
- Dorsal setae of the *J* series subequal in length 30
- 30 Dorsal seta *Z*₅ pilose distally and about three times the length of simple seta *J*₅ (Text-fig. 37A) ; movable digit of the chelicera edentate (Text-fig. 37B) **H. montana** (Berlese) (p. 206)
- Dorsal seta *Z*₅ less than twice the length of seta *J*₅ (Text-fig. 36A) ; movable digit of the chelicera dentate (Text-fig. 36D) **H. isotricha** (Kolenati) (p. 203)

Hypoaspis krameri (Canestrini)

Gamasus krameri Canestrini G. & R., 1881, *Atti Ist. Veneto* (5) 7: 1083, figs.

Female : Chelicera with segment I, 72 μ ; II, 180 μ ; movable digit 80 μ , bidentate ; fixed digit with about ten teeth (Text-fig. 13D) ; pilus dentilis short, setiform ; dorsal seta about twice as long as the pilus. Four pairs of gnathosomal setae with *c.s.* about 72 μ apart, *hyp.*₂ about 60 μ apart. Deutosternum with six transverse rows of denticles (6–7 per row) ; corniculi 66 μ ; internal malae as in Text-fig. 13C. Tectum capituli with anterior margin denticulate (Text-fig. 13B). Salivary stylus extends nearly to tip of corniculus. Pedipalp (2–5–6–14) with two-tined apotele.

Dorsal shield (684 μ $\times$ 396 μ) with 37 pairs of setae distributed as in Text-fig. 13A ; seta *s*₃, the humeral seta and seven pairs of marginal setae on the cuticle. Setae *j*₂–*j*₃, *z*₂–*z*₆, considerably longer than the other setae, seta *Z*₄ extremely long and sinuous ; no hypertrichy. Surface of shield granular.

Tritosternum with base 45 μ , laciniae 123 μ . Sternal shield (117 μ $\times$ 150 μ) with three pairs of setae and three pairs of pores, the third pair being on the posterior margin of the shield ; metasternal setae free. Between *st*₁, 93 μ ; between *st*₁ and *st*₃, 114 μ . Genital shield (114 μ $\times$ 105 μ) with genital setae only. Anal shield (93 μ $\times$ 72 μ) with paranal setae 48 μ , postanal seta 30 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 13F. Peritreme extends beyond middle of coxa I ; peritrematal shields free anteriorly and posteriorly.

Legs with normal chaetotaxy. Long, whip-like setae present on femur II (*pd*₁), femur IV (*ad*₁) and tarsus IV (*ad*₂ and *pd*_{2–3}), Text-fig. 14A. Tarsus II with two

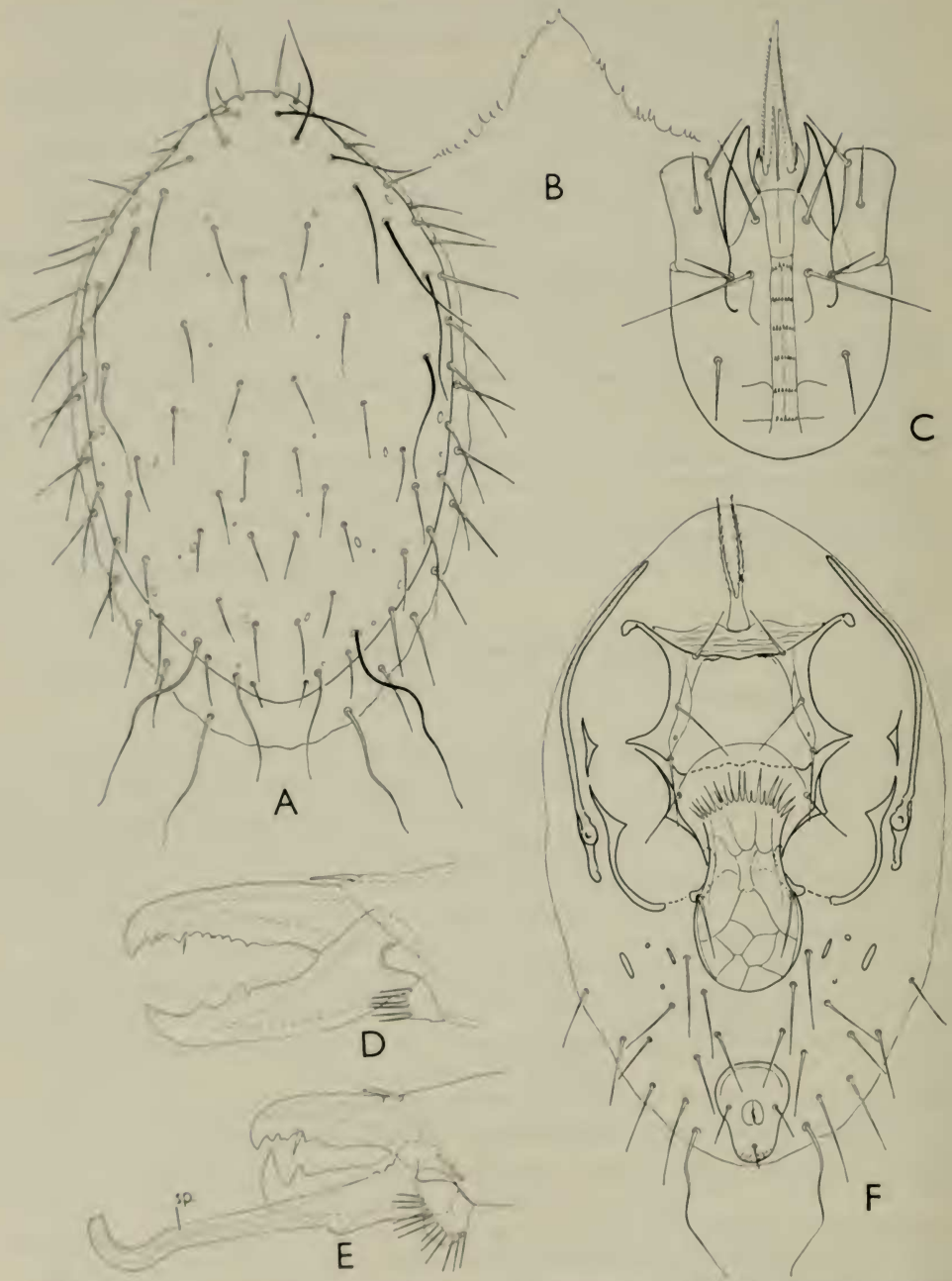


FIG. 13. *Hypoaspis krameri* (Canestrini). A. Dorsum of idiosoma of female; B. tectum capiti of female; C. venter of gnathosoma of female; D. chelicera of female; E. chelicera of male; F. venter of idiosoma of female.

stout, blunt setae (al_1 and pl_1) and several which are stout basally, tapering to fine points (av_{1-2} , pv_{1-2} , mv); relatively thick setae on tibia II (av_1 and pv_1) and genu II (av). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	93/42	84/57	66/45	90/45
tibia	108/33	84/54	75/42	100/45
tarsus	140/33	120/42	144/36	190/36

Male: Chelicera with segment I, 72 μ ; II, 168 μ ; movable digit 70 μ , unidentate; spermadactyl 130 μ long, slender (Text-fig. 13E); fixed digit tridentate; pilus dentilis and dorsal seta as in female. Four pairs of gnathosomal setae with c.s. about 60 μ apart, *hyp.2* about 50 μ apart. Details of gnathosomal structure not clearly visible.

Dorsal shield (636 $\mu \times$ 348 μ) as in female. Tritosternum with base 45 μ , laciniae 114 μ . Holoventral shield (516 $\mu \times$ 114 μ) with four pairs of setae in the sternal region, six pairs in the genito-ventral region; moderately expanded behind coxae IV but not extending beyond lateral margins of the coxae. Between *st1*, 80 μ ; between *st1* and *st3*, 123 μ . Peritreme extends beyond middle of coxa I.

Legs with normal chaetotaxy; long whip-like setae on legs II and IV as in female. Leg II (Text-fig. 14B) bears several stout setae: av_1 and especially av_2 on the femur;

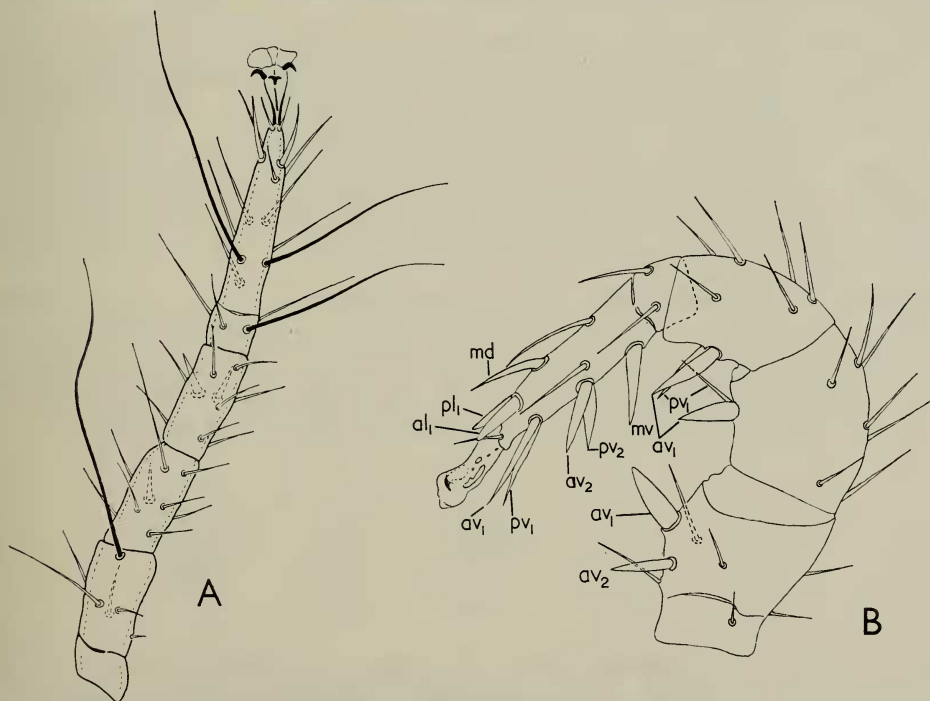


FIG. 14. *Hypoaspis krameri* (Canestrini). A. Leg IV of female; B. leg II of male.

av on the genu ; *av* and *pv* on the tibia ; *al*₁, *pl*₁, *av*₂, *pv*₂, *mv* on the tarsus ; setae *av*₁, *pv*₁ and *md* on the tarsus are fairly stout basally, tapering to fine points. Legs all bent and not suitable for measurement.

HABITAT : Recorded from *Lucanus* sp. (Coleoptera) in Britain and from *Oryctes nasicornis* Linn. in the Netherlands.

Hypoaspis aculeifer (Canestrini)

Laelaps aculeifer Canestrini, 1884, *Atti Ist. Veneto* (6) 2 : 698.

Hypoaspis aculeifer : Bregetova, 1956, *Opred. Faune SSSR*. 61 : 77, figs. 102-106.

Female : Chelicera with segment I, 75 μ ; II, 216 μ ; movable digit 98 μ , bidentate ; fixed digit with about 10 teeth (Text-fig. 15B) ; pilus dentilis short, setiform. Four pairs of gnathosomal setae with *c.s.* about 66 μ apart and *hyp.2* about 50 μ apart. Deutosternum with six transverse rows of denticles ; corniculi 60 μ long ; internal malae fringed (Text-fig. 15D). Tectum capituli with denticulate anterior margin (Text-fig. 15F). Salivary styli conspicuous. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (684 μ $\times$ 360 μ) with normal 39 pairs of simple setae distributed as in Text-fig. 15A. Setae of podonotal region conspicuously longer than those on the opisthonotal region. Surface of shield reticulate ; no hypertrichy ; with seven pairs of *R* setae on the cuticle.

Tritosternum with base 48 μ , laciniae 105 μ . Sternal shield (190 μ $\times$ 138 μ) extending almost to posterior margin of coxa III, with three pairs of setae and two pairs of pores ; metasternal setae free with associated pores. Between *st1*, 75 μ ; between *st1* and *st3*, 144 μ . Genital shield flask-shaped (120 μ $\times$ 96 μ) with one pair of setae. Anal shield (90 μ $\times$ 75 μ), with paranal seta 27 μ and postanal seta 36 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 15C. Peritreme extends to middle of coxa I ; peritrematal shields free posteriorly, anterior region fused with dorsal shield at level of *vr1*.

Legs with normal chaetotaxy. Tarsus II with setae *av*₁₋₂, *pv*₁₋₂, *al*₁, *pl*₁, *md*, *mv*, *ad*₂, stout and spine-like. Tibia II with *av* and *pv* stout ; genu II with *av* stout ; femur II with *a v*₁ stout. Stout setae are found on genu III (*av* and *pv*), tibia III (*av* and *pv*), tarsus III (most setae, except *al*₂, *pl*₂, *ad*₃, *pd*₃), genu IV (*av*), tibia IV (*av*₁, *pv*₁, *pl*₁) and tarsus IV (most setae). Length/width (in μ) of leg segments :

	I	II	III	IV
genu	96/40	105/66	63/50	105/63
tibia	114/30	96/66	66/48	120/63
tarsus	180/28	135/48	156/40	240/48

Male : Chelicera with segment I, 54 μ ; II, 130 μ ; movable digit 60 μ , unidentate, spermadactyl as in Text-fig. 15G ; fixed digit with about 5 teeth ; pilus dentilis short, setiform. Four pairs of gnathosomal setae with *c.s.* about 50 μ apart, *hyp.2*

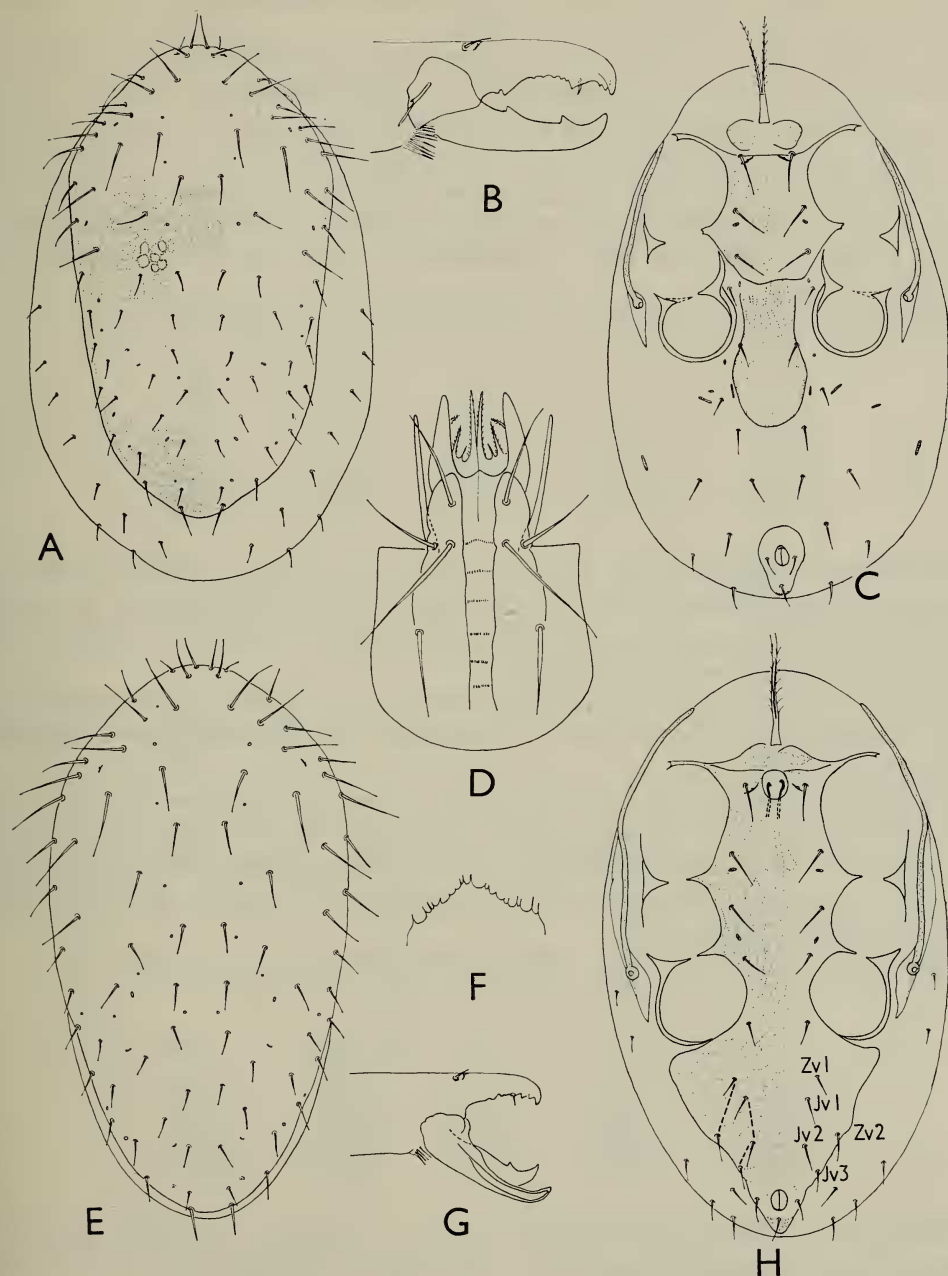


FIG. 15. *Hypoaspis aculeifer* (Canestrini). A. Dorsum of idiosoma of female; B. chelicera of female; C. venter of idiosoma of female; D. venter of gnathosoma of female; E. dorsum of idiosoma of male; F. tectum capituli of female; G. chelicera of male; H. venter of idiosoma of male.

about $42\ \mu$ apart. Deutosternum, internal malae, tectum capituli as in female; corniculi $54\ \mu$ long. Pedipalps as in female.

Dorsal shield ($540\ \mu \times 276\ \mu$) with 39 pairs of setae distributed as in Text-fig. 15E. Tritosternum with base $27\ \mu$, laciniae $78\ \mu$. Holoventral shield ($456\ \mu \times 114\ \mu$) with three pairs of sternal, one pair of metasternal setae and three pairs of pores in the sternal region; between *st*1, $63\ \mu$; between *st*1 and *st*3, $126\ \mu$. Genito-ventral region with six pairs of setae. Paranal setae about $24\ \mu$, postanal seta about $20\ \mu$ long. Chaetotaxy of opisthogaster as in Text-fig. 15H. Peritreme extends nearly to middle of coxa I; anterior part of peritrematal shield fused with dorsal shield; posterior part free.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	75/33	80/54	50/42	84/54
tibia	90/27	75/54	50/40	90/54
tarsus	150/24	110/40	130/36	186/45

Protonymph: Chelicera with segment I, $40\ \mu$; II, $132\ \mu$; movable digit $50\ \mu$. Four pairs of gnathosomal setae with c.s. about $45\ \mu$ apart, *hyp*.2 about $36\ \mu$ apart. Deutosternum, internal malae and tectum as in female; corniculi $36\ \mu$ long. Pedipalp (1-4-5-12) with two-tined apotele.

Podonotal shield ($258\ \mu \times 190\ \mu$) with eleven pairs of setae; pygidial shield ($90\ \mu \times 120\ \mu$) with eight pairs of setae; chaetotaxy and sclerotization of mesonotal region as in Text-fig. 16A.

Tritosternum with base $30\ \mu$, laciniae $60\ \mu$. Sternal shield ($170\ \mu \times 80\ \mu$) with three pairs of setae and two pairs of pores; between *st*1, about $48\ \mu$; between *st*1 and *st*3, about $120\ \mu$. Anal shield ($50\ \mu \times 42\ \mu$) with paranal setae $20\ \mu$ and postanal seta $18\ \mu$ long. Chaetotaxy of opisthogaster as in Text-fig. 16 B. Peritreme extends to middle of coxa III.

Legs with normal chaetotaxy. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	60/30	60/36	40/30	57/33
tibia	66/30	50/40	42/30	60/36
tarsus	114/27	78/33	87/27	130/33

Deutonymph: Chelicera with segment I, $40\ \mu$; II, $147\ \mu$; movable digit $57\ \mu$. Deutosternum, hypostomal processes, corniculi and tectum as in protonymph. Pedipalp (2-5-6-14) as in female.

Dorsal shield ($450\ \mu \times 216\ \mu$) with lateral incisions, bearing 39 pairs of setae arranged as in Text-fig. 16C; no hypertrichy; with seven pairs of *R* setae on the cuticle.

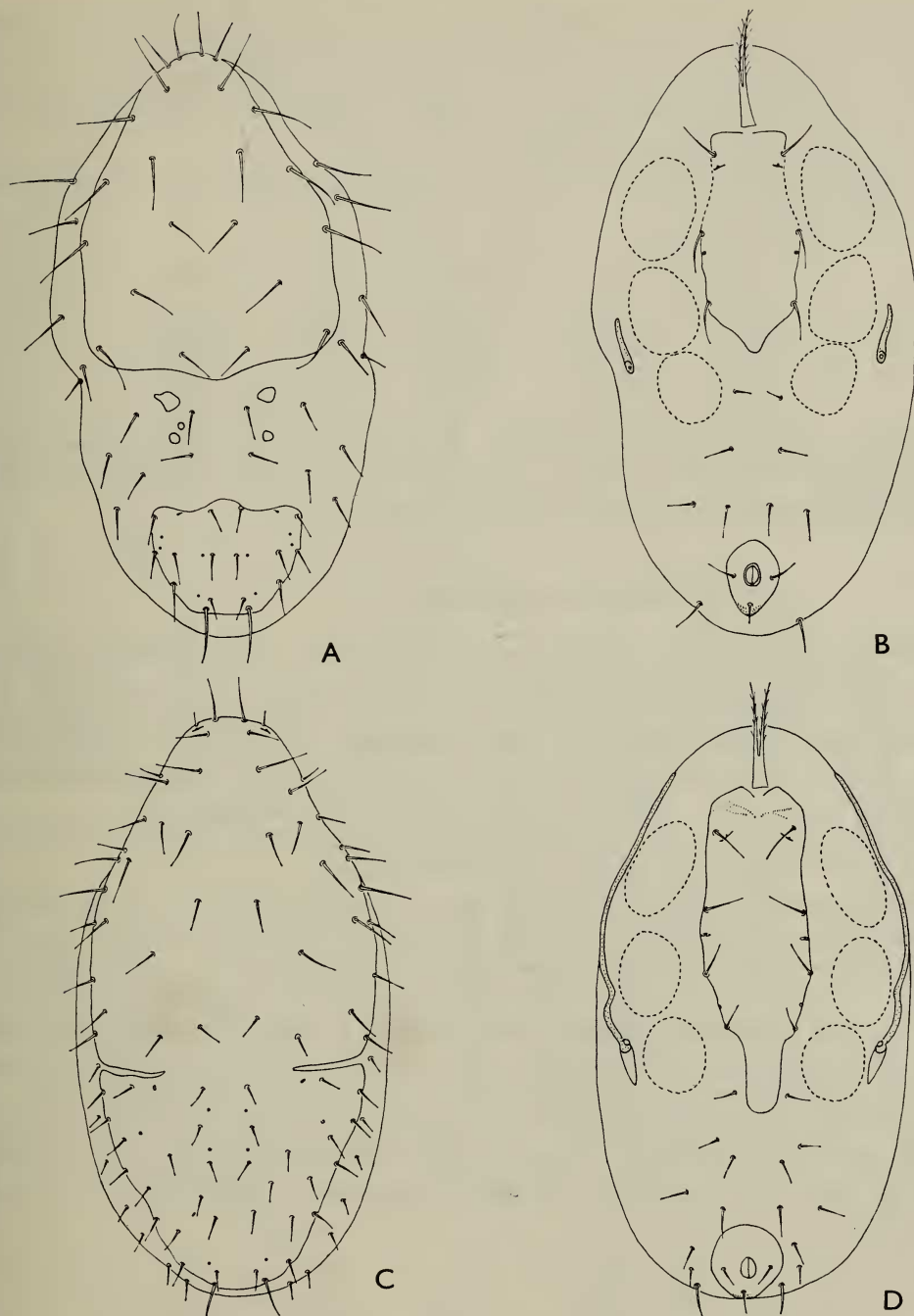


FIG. 16. *Hypoaspis aculeifer* (Canestrini). A. Dorsum of idiosoma of protonymph; B. venter of idiosoma of protonymph; C. dorsum of idiosoma of deutonymph; D. venter of idiosoma of deutonymph.

Tritosternum with base $40\ \mu$, laciniae $65\ \mu$. Sternal shield ($243\ \mu \times 82\ \mu$) bears three pairs of sternal, one pair of metasternal setae and three pairs of pores; between *st1*, $60\ \mu$; between *st1* and *st3*, $114\ \mu$. Anal shield (approximately $57\ \mu \times 50\ \mu$) with par- and postanal setae about $18\ \mu$ long. Chaetotaxy of opisthogaster as in Text-fig. 16D. Peritreme as in female.

Chaetotaxy of legs normal. Tibia IV with *av*₁, *pv*₁ and *pl*₁ stout. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	66/33	72/48	48/42	60/42
tibia	78/30	57/48	48/40	72/50
tarsus	123/24	96/30	102/30	135/36

HABITAT: Common in soil and litter. Recorded from the nest of *Riparia riparia* (Linn.) in Gloucestershire, Britain; from the nest of *Spalax ehrenbergi* Nehring in Israel and the nests of a variety of rodents in the U.S.S.R.

Hypoaspis giffordi sp. nov.

Female: Chelicera with segment I, $45\ \mu$; II, $120\ \mu$; movable digit $45\ \mu$, bidentate; fixed digit with three small teeth, pilus dentilis short, setiform (Text-fig. 17D). Four pairs of gnathosomal setae with *c.s.* about $45\ \mu$ apart, *hyp.2* about $36\ \mu$ apart. Deutosternum with six transverse rows of denticles (3–7 per row); corniculi $36\ \mu$ long; internal malae reduced (Text-fig. 17B). Tectum capituli with anterior margin smooth (Text-fig. 17C). Pedipalp (2–5–6–14) with two-tined apotele.

Dorsal shield ($480\ \mu \times 276\ \mu$) with 39 pairs of setae and four accessory setae distributed as in Text-fig. 17A. Surface of shield reticulate.

Tritosternum with base $24\ \mu$, laciniae $54\ \mu$. Sternal shield ($100\ \mu \times 84\ \mu$) weakly reticulate anteriorly and laterally, with three pairs of setae and two pairs of pores. Metasternal setae free with associated pores. Between *st1*, $60\ \mu$; between *st1* and *st3*, $90\ \mu$. Genital shield ($84\ \mu \times 93\ \mu$) with genital setae only. Anal shield ($60\ \mu \times 72\ \mu$) with paranal and postanal setae about $20\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 17E. Peritreme extends to middle of coxa I; anterior tip of peritrematal shield fused with dorsal shield; posterior part free.

Chaetotaxy of legs normal except in one specimen in which genu IV has a postero-ventral seta on one side only. Tarsus II with ventral setae, *al*₁, *pl*₁ and *md* stouter than the other setae; tarsus IV with seta *pl*₂ spine-like. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	63/30	54/36	40/28	60/28
tibia	70/27	48/33	36/28	60/28
tarsus	110/24	80/24	82/42	117/24

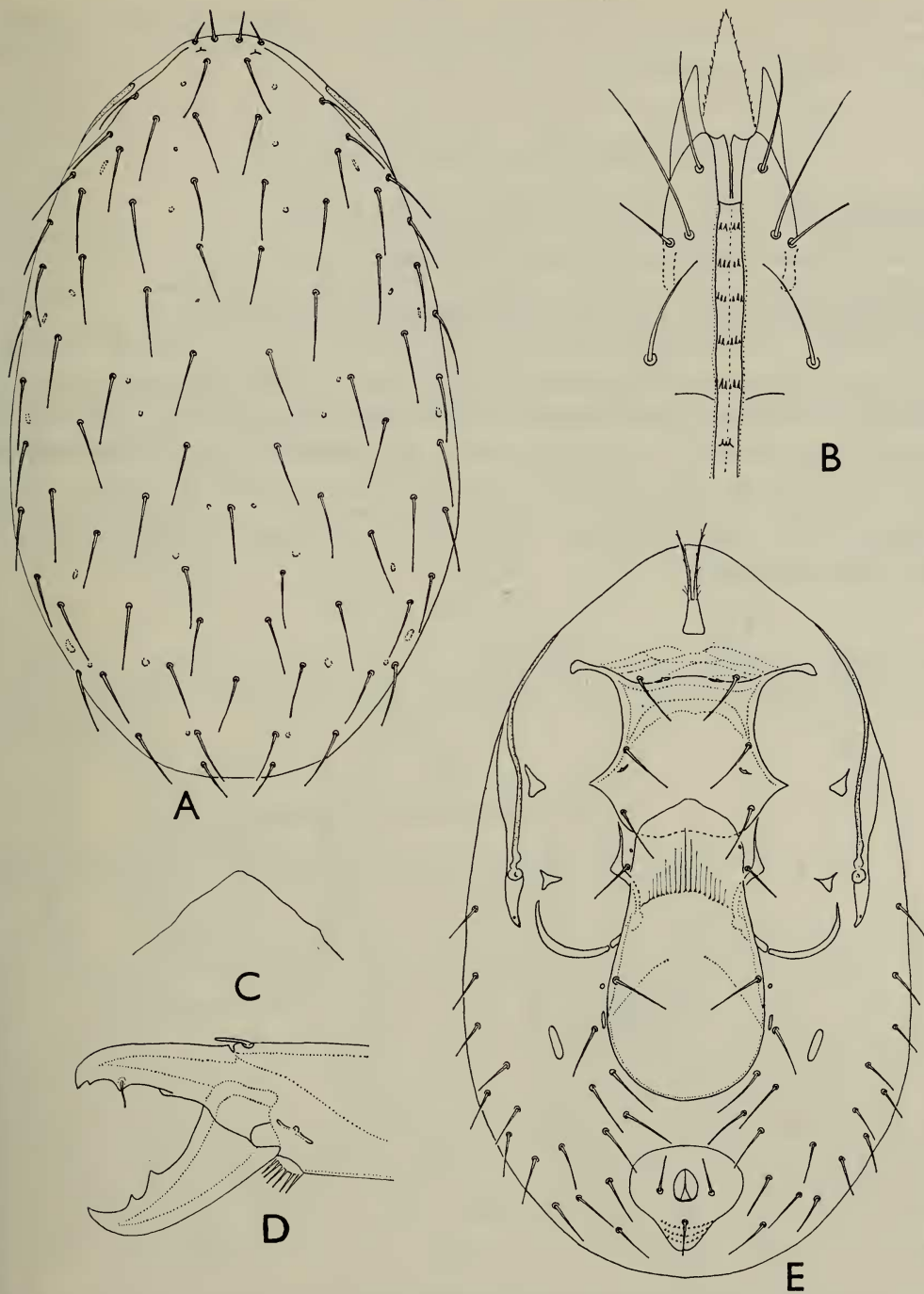


FIG. 17. *Hypoaspis giffordi* sp. nov., female; dorsum of idiosoma (A); deutosternum and hypostome (B); tectum capituli (C); chelicera (D); venter of idiosoma (E).

HABITAT: Found on birch timber rotted by *Polyporus betulinus*, Rannoch, Perthshire. Collected by D. R. Gifford, November, 1962. Holotype ♀ (1965 : 12 : 29 : 3), paratype ♀ (1965 : 12 : 29 : 4).

Hypoaspis lubrica Voigts & Oudemans

Hypoaspis lubrica Voigts & Oudemans, 1904, *Zool. Anz.* **27** : 654.

Samsinak, 1960, *Acta Soc. ent. Cech.* **57** : 278, fig. 2 (1-9).

Hypoaspis (Haemolaelaps) inversus Berlese, 1918, *Redia* **13** : 127.

Hypoaspis compressus Hull, 1925, *Ann. Mag. nat. Hist.* (9) **15** : 209 (**syn. nov.**)

Hypoaspis smithii Hughes, 1948, *Mites associated with stored food products* : 131.

Hypoaspis murinus Strandtmann & Menzies, 1948 (1949), *Ann. ent. Soc. Amer.* **41** : 479, figs.

Female : Chelicera with segment I, 66 μ ; II, 156 μ ; movable digit 56 μ , bidentate ; fixed digit tridentate ; pilus dentilis short, setiform (Text-fig. 18B). Four pairs of gnathosomal setae with c.s. about 66 μ apart ; *hyp.2* about 42 μ apart. Deutosternum with six transverse rows of denticles (7-10 per row) ; corniculi 45 μ long ; internal malae fringed. Tectum capituli with fine striations and a smooth anterior margin (Text-fig. 18c). Salivary stylus reaches tip of corniculus. Pedipalp (2-5-6-14) with two-tined apotele.

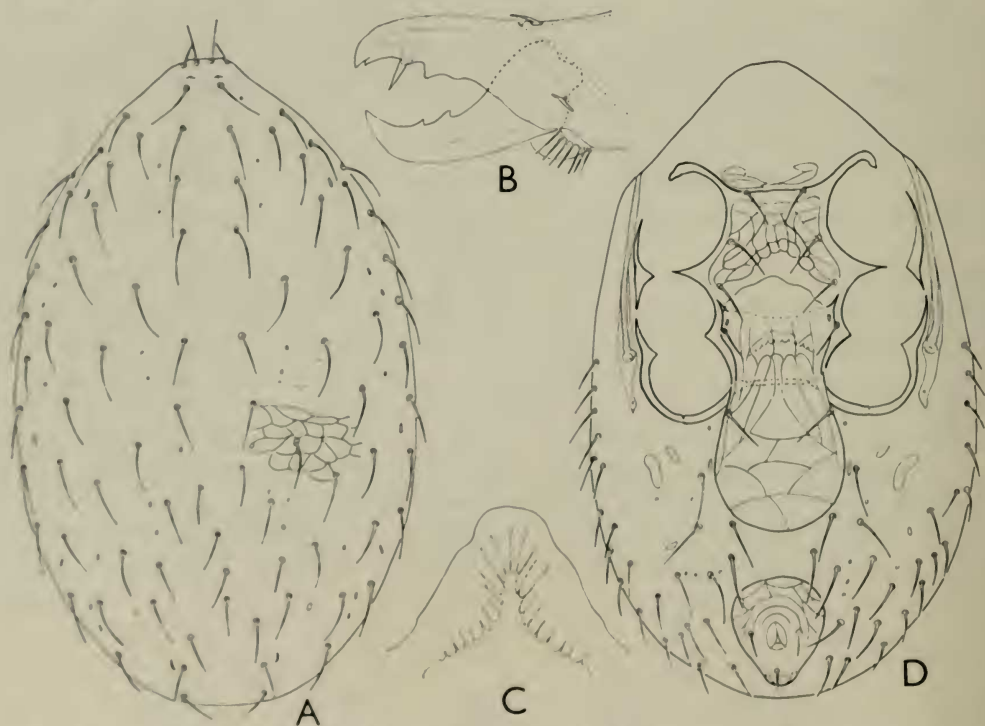


FIG. 18. *Hypoaspis lubrica* Voigts and Oudemans, female ; dorsum of idiosoma (A) ; chelicera (B) ; tectum capituli (C) ; venter of idiosoma (D).

Dorsal shield ($708 \mu \times 420 \mu$) with 39 pairs of setae and 4-9 accessory setae distributed as in Text-fig. 18A. Surface of shield reticulated.

Tritosternum with base 30μ , laciniae 90μ . Sternal shield ($132 \mu \times 120 \mu$) extending to middle of coxa III, with three pairs of setae and two pairs of pores; metasternal setae free with associated pores. Between *st*1, 70μ ; between *st*1 and *st*3, 112μ . Genital shield ($150 \mu \times 117 \mu$) flask-shaped with one pair of setae. Anal shield ($110 \mu \times 105 \mu$) with par- and postanal setae 36μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 18D. Peritreme extends to beyond middle of coxa I; peritrematal shield fused anteriorly with dorsal shield, posterior part free.

Chaetotaxy of legs differs from typical pattern in having a postero-ventral seta on genu IV. Setae *av*₁, *pv*₁, *al*₁, *pl*₁ on tarsus II are stout and spine-like; setae *av*₂, *pv*₂ and *mv* are stout and pointed. Tibia II has stout ventral setae (*av*₁ and *pv*₁). Legs III and IV bear many stout ventral setae on the genu, tibia and tarsus. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	87/38	84/50	54/40	90/42
tibia	96/36	75/48	57/40	90/40
tarsus	147/33	105/36	130/33	174/33

HABITAT: In decaying oats and hay; in the nest of *Riparia riparia* (Linn.); on a variety of rodents and in their nests. Recorded from Britain, Europe, the U.S.S.R. and the U.S.A.

Hypoaspis praesternalis Willmann

Hypoaspis praesternalis Willmann, 1949, *Veröff. Mus. Nat. Bremen* no. 1A: 115, figs.

Hypoaspis noll Karg, 1962, *Mitt. zool. Mus. Berlin* 38: 62, figs. (**syn. nov.**).

Female: Chelicera with segment I, 50μ ; II, 144μ ; movable digit 60μ , bidentate; fixed digit with bifid tip and four teeth, pilus dentilis short, setiform. Four pairs of gnathosomal setae with *c.s.* about 45μ apart, *hyp*.2 about 42μ apart. Deutosternum with six transverse rows of fine denticles; corniculi 52μ long; internal malae slender, triangular, fringed. Tectum capituli with anterior margin denticulate (Text-fig. 19C). Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield ($492 \mu \times 264 \mu$) with 39 pairs of setae distributed as in Text-fig. 19A. No hypertrichy. Surface of shield reticulate. Two pairs of *R* setae on the cuticle.

Tritosternum with base 36μ , laciniae 84μ ; presternal area reticulate and granular. Sternal shield ($138 \mu \times 105 \mu$) with reticulate pattern most pronounced laterally; with three pairs of setae and two pairs of pores; metasternal setae free with associated pores. Between *st*1, 75μ ; between *st*1 and *st*3, 100μ . Genital shield ($90 \mu \times 72 \mu$) with genital setae only. Anal shield ($72 \mu \times 70 \mu$) with paranal and postanal setae about 33μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 19E.

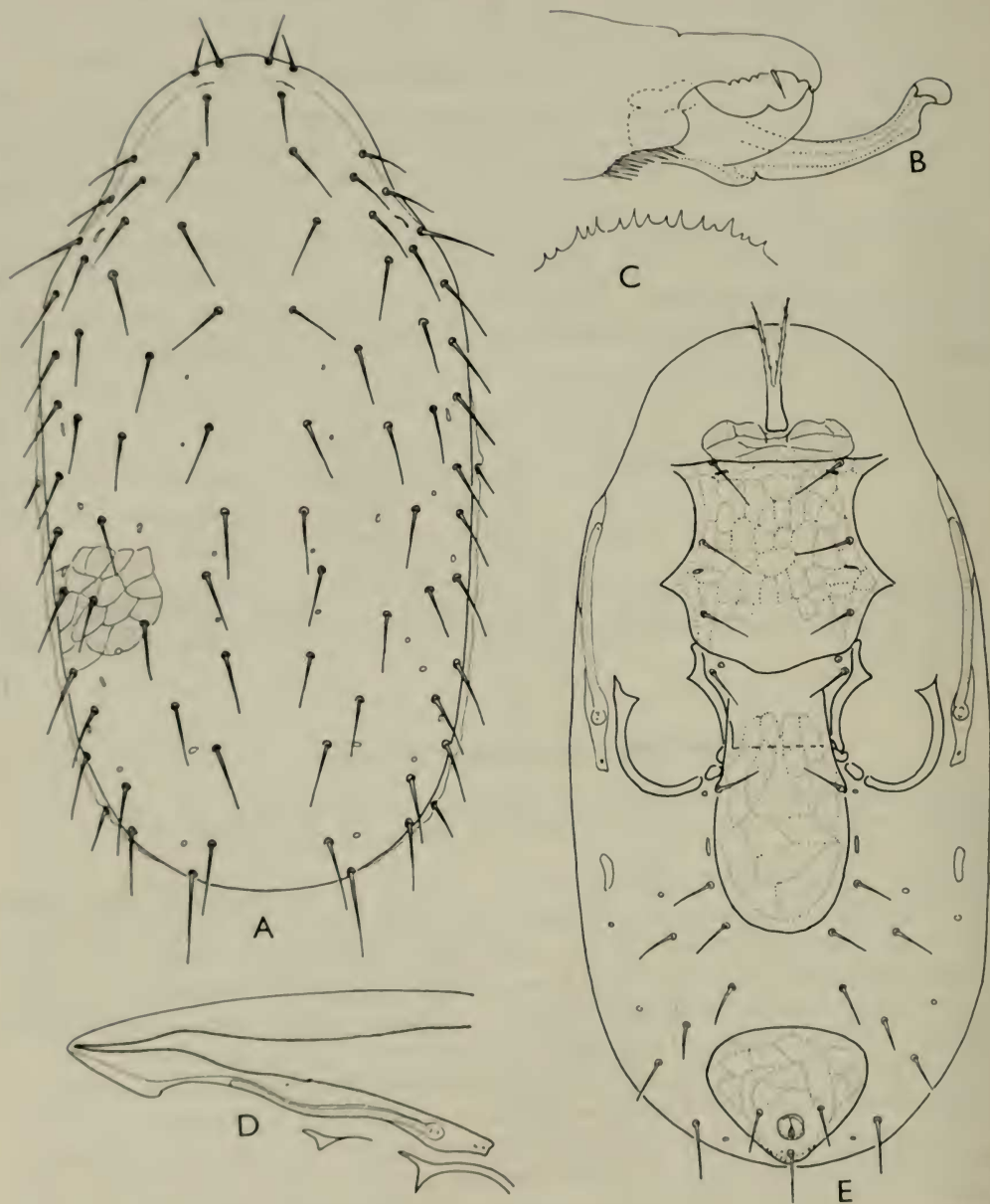


FIG. 19. *Hypoaspis praesternalis* Willmann. A. Dorsum of idiosoma of female; B. chelicera of male; C. tectum capituli of female; D. peritreme and peritrematal shield of female; E. venter of idiosoma of female.

Peritreme extends to about middle of coxa II ; anterior part of peritrematal shield fused with dorsal shield, posterior part free (Text-fig. 19D).

Chaetotaxy of legs normal. Tarsi II–IV with ventral setae relatively stout basally, tapering to long, fine points. Tarsus IV with setae pl_2 and pl_3 relatively stout and blade-like. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	68/30	60/36	40/27	63/30
tibia	75/24	54/36	40/27	66/32
tarsus	130/20	80/30	72/24	117/27

Male : Chelicera with segment I, 40 μ ; II, 105 μ ; movable digit 42 μ , unidentate ; fixed digit with bifid tip and four teeth, pilus dentilis simple ; spermadactyl large as in Text-fig. 19B. Four pairs of gnathosomal setae with c.s. about 42 μ apart, *hyp.2* about 36 μ apart. Corniculi 36 μ long and set wider apart than in the female. Tectum and pedipalps as in female.

Dorsal shield (420 $\mu \times$ 228 μ) with chaetotaxy similar to that in the female except for the absence of setae px_2 in the opisthonotal region. Surface of shield reticulated.

Tritosternum with base 15 μ , laciniae 70 μ . Holoventral shield (348 $\mu \times$ 93 μ) with four pairs of setae and three pairs of pores in the sternal region, five pairs in the genito-ventral region ; anal region with normal three setae. Between *st1*, 66 μ ; between *st1* and *st3*, 90 μ . Par- and post-anal setae subequal in length. Peritreme extends to about the middle of coxa II ; peritrematal shield free posteriorly.

Chaetotaxy of legs as in female. Setae of femur II simple. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	66/27	54/36	36/30	57/33
tibia	68/24	48/33	36/27	60/30
tarsus	117/20	72/27	70/24	105/26

HABITAT : Recorded from soil, grassland and marshes in Britain and Europe.

Hypoaspis sardoa (Berlese)

Laelaps (Androlaelaps) sardous Berlese, 1911, *Redia* 7 : 433.

Bregetova, 1956, *Opred. Faune SSSR*. 61 : 83, figs. 120–122.

Hypoaspis laevis var. *pilifer* Oudemans, 1912, *Ent. Ber. Amst.* 3 : 231.

Female : Chelicera with segment I, 102 μ ; II, 228 μ ; movable digit 90 μ , bidentate ; fixed digit with three teeth and a row of serrations ; pilus dentilis short, setiform (Text-fig. 20C). Four pairs of gnathosomal setae with c.s. about 68 μ apart, *hyp.2* about 57 μ apart. Deutosternum with six transverse rows of denticles (4–8 per row) ; corniculi 90 μ long ; internal malae fringed (Text-fig. 20E). Tectum

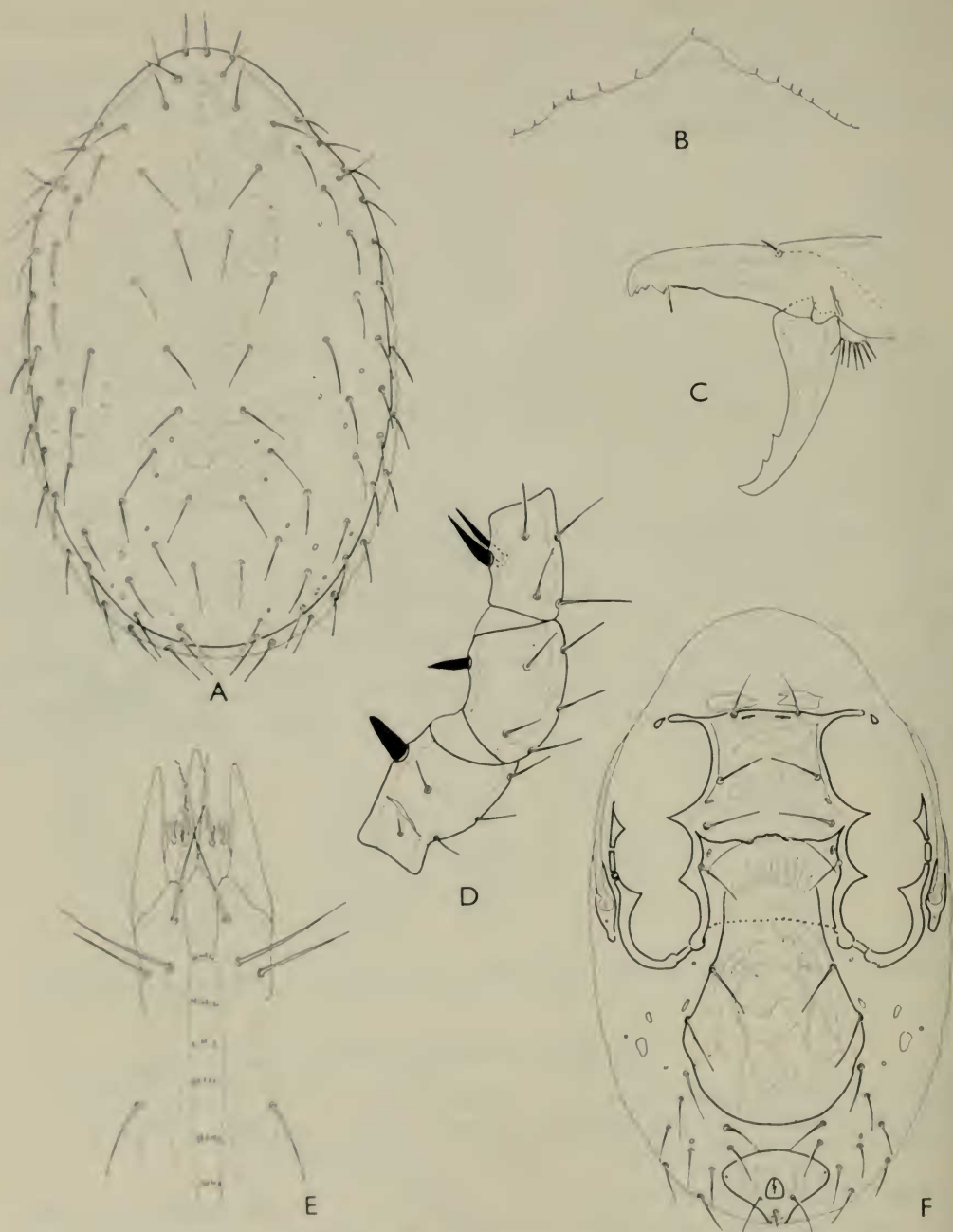


FIG. 20. *Hypoaspis sardoa* (Berlese), female; dorsum of idiosoma (A); tectum (B); chelicera (C); femur, genu and tibia of leg II (D); deutosternum and hypostome (E); venter of idiosoma (F).

capituli with denticulate anterior margin (Text-fig. 20B) ; salivary styli reach nearly to tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield ($732 \mu \times 456 \mu$) with 39 pairs of setae (Text-fig. 20A). Surface of shield reticulated ; no hypertrichy ; one pair of *r* and six pairs of *R* setae on the cuticle.

Tritosternum with base 48μ , laciniae 120μ . Sternal shield ($170 \mu \times 156 \mu$) with three pairs of setae and two pairs of pores ; metasternal setae free with associated pores. Between *st*1, 84μ ; between *st*1 and *st*3, 160μ . Genital shield ($216 \mu \times 156 \mu$) flask-shaped, with two pairs of setae. Anal shield ($80 \mu \times 114 \mu$) with maximum width 140μ ; paranal setae about 66μ , postanal seta about 33μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 20F. Peritreme extends to anterior margin of coxa II ; peritrematal shield has anterior part fused with dorsal shield, posterior part free.

Chaetotaxy of legs differs from normal pattern in that tibia III and genu IV each have a second postero-lateral seta. Femur II has a stout, blunt seta (*av*₁) ; genu II has one (*av*₁) and tibia II has two (*av*₁ and *pv*₁) stout, pointed setae (Text-fig. 20D). On tarsus II setae *av*₁₋₂, *pv*₁₋₂ and *mv* are stout and pointed. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	108/48	114/66	84/48	120/48
tibia	126/45	105/60	90/48	132/48
tarsus	198/42	150/45	170/42	230/40

HABITAT : In litter and in the nests, more rarely on the bodies, of moles and field mice (*Apodemus flavicollis* (Melchior) and *A. sylvaticus* (Linn.)) in Britain, Europe and the U.S.S.R. Recorded by Bregetova from the nest of *Phoenicurus phoenicurus* (Linn.).

Hypoaspis heselhausi Oudemans

Hypoaspis heselhausi Oudemans, 1912, *Ent. Ber. Amst.* **3** : 216.

Bregetova, 1956, *Opred. Faune SSSR.* **61** : 78, figs.

Female : Chelicera with segment I, 45μ ; II, 126μ ; movable digit 48μ , bidentate ; fixed digit with five teeth, pilus dentilis short, setiform, dorsal seta a little longer and stouter than the pilus (Text-fig. 21C). Four pairs of gnathosomal setae with c.s. about 45μ apart, *hyp*.2 about 30μ apart. Deutosternum with six transverse rows of denticles (4-6 per row) ; corniculi 36μ long ; internal malae as in Text-fig. 21B. Tectum capituli with anterior margin smooth. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield ($480 \mu \times 280 \mu$) with 39 pairs of short, simple setae distributed as in Text-fig. 21A. Surface of shield with scale-like markings.

Tritosternum with base 36μ , laciniae 72μ . Sternal shield ($108 \mu \times 102 \mu$) with three pairs of setae and two pairs of pores ; metasternal setae free with associa-

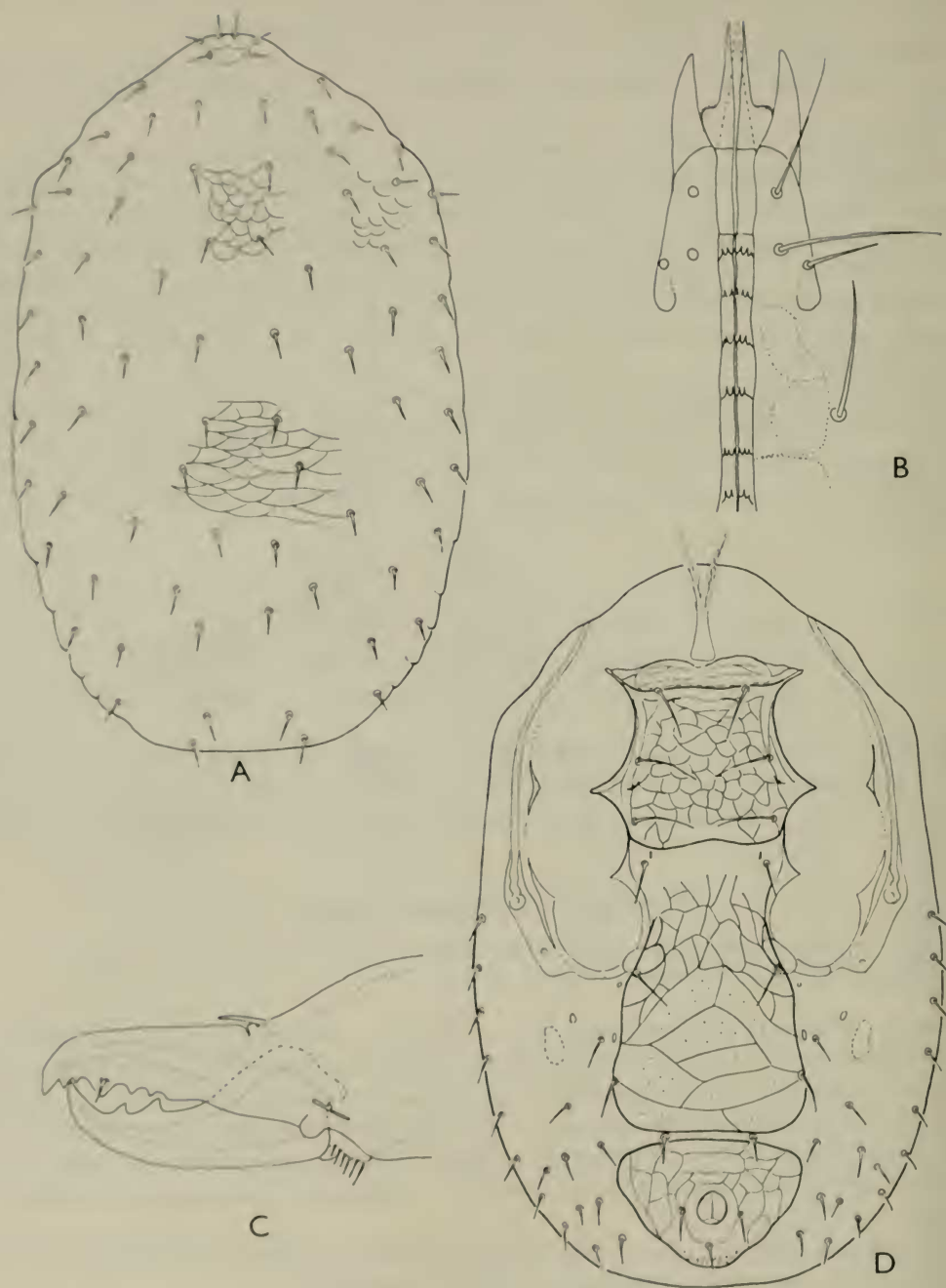


FIG. 21. *Hypoaspis heselhausi* Oudemans, female; dorsum of idiosoma (A); deutosternum and hypostome (B); chelicera (C); venter of idiosoma (D).

ted pores. Between *st*1, 56 μ ; between *st*1 and *st*3, 96 μ . Genito-ventral shield (108 $\mu \times$ 84 μ) with maximum width (135 μ) near posterior margin, bearing a pair of genital and a pair of opisthogastric setae. Anal shield (75 $\mu \times$ 105 μ) with maximum width (117 μ) near anterior margin; paranal setae 20 μ , postanal seta 18 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 21D. Peritreme extends to middle of coxa I; anterior tip of peritrematal shield fused with dorsal shield, posterior part completely or incompletely fused with podal shield of coxa IV.

Legs with normal chaetotaxy. Cuticle of legs with warty appearance. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	60/27	57/38	36/30	57/33
tibia	63/27	48/36	36/30	57/30
tarsus	108/25	72/27	80/24	90/27

HABITAT: In the nests of *Talpa europaea* Linn. and *Microtus arvalis* (Pallas) in Britain, the Netherlands and the U.S.S.R. We have also examined specimens from the nest of *Bombus lapidarius* (Linn.) at Langley Park, Buckinghamshire (coll. K. F. Colombo).

Hypoaspis nidicorva sp. nov.

Female: Chelicera with segment I, 70 μ ; II, 180 μ ; movable digit 75 μ , bidentate; fixed digit tridentate; pilus dentilis short, setiform (Text-fig. 23E). Four pairs of gnathosomal setae with *c.s.* about 54 μ apart, *hyp.2* about 42 μ apart. Deutosternum with six transverse rows of denticles (6–7 per row); corniculi 66 μ long; internal malae with a deep fringe as in Text-fig. 23F. Tectum capituli with anterior margin smooth (Text-fig. 23B). Salivary styli conspicuous, extending a little beyond tips of corniculi. Pedipalp (2–5–6–14) with two-tined apotele.

Dorsal shield (624 $\mu \times$ 384 μ) with 39 pairs of setae and three accessory setae distributed as in Text-fig. 22A. Surface of shield reticulate and granular.

Tritosternum with base 48 μ , laciniae 102 μ . Sternal shield (110 $\mu \times$ 130 μ) granular, anterior two-thirds reticulate, with three pairs of setae and two pairs of pores. Metasternal setae free with associated pores. Between *st*1, 70 μ ; between *st*1 and *st*3, 105 μ . Genito-ventral shield (216 $\mu \times$ 120 μ) flask-shaped, posterior margin truncate, very close to anal shield; bearing one pair of genital and three pairs of opisthogastric setae. Between *Jv*2, 162 μ . Anal shield (78 $\mu \times$ 105 μ) with maximum width at anterior margin (132 μ); paranal setae 30 μ ; postanal seta 45 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 22B. Peritreme extends beyond posterior margin of coxa I; anterior part of peritrematal shield fused with dorsal shield; posterior part fused with podal shield of coxa IV.

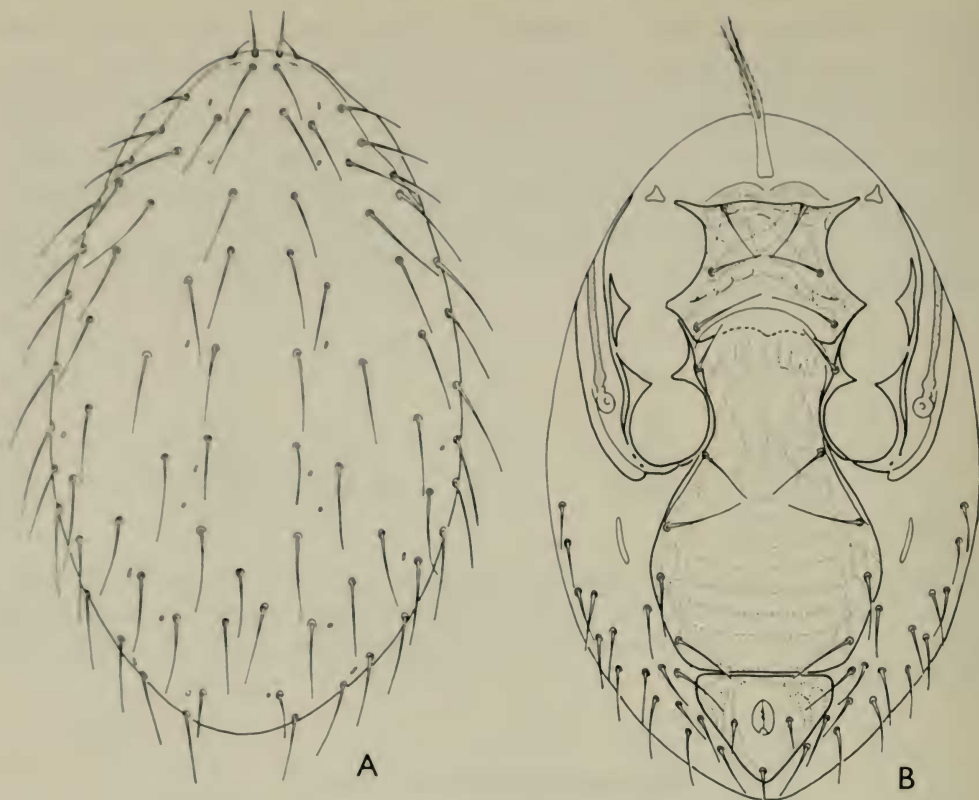


FIG. 22. *Hypoaspis nidicorva* sp. nov., female; dorsum (A) and venter (B) of idiosoma.

Chaetotaxy of legs normal. Dorsal seta on trochanter IV relatively stout. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	84/36	75/42	54/30	78/30
tibia	90/30	70/42	54/30	80/27
tarsus	132/30	102/30	110/24	162/24

Male: Chelicera with segment I, 40 μ ; II, 117 μ ; movable digit 45 μ , as long as spermadactyl, unidentate; fixed digit unidentate, pilus dentilis short, setiform (Text-fig. 23c). Four pairs of gnathosomal setae with c.s. about 40 μ apart, *hyp.2* about 36 μ apart. Corniculi 48 μ long. Deutosternum, internal malae, tectum and pedipalps as in female.

Dorsal shield (396 $\mu \times$ 267 μ) as in female, with 39 pairs of setae and one or two accessory setae. Tritosternum with base 36 μ , laciniae 105 μ . Holoventral shield (360 $\mu \times$ 96 μ) with four pairs of setae and three pairs of pores in the sternal

region, one pair of genital and five pairs of opisthogastric setae in the genito-ventral region (Text-fig. 23A). Between $st1$, $48\ \mu$; between $st1$ and $st3$, $90\ \mu$. Paranal setae $24\ \mu$; postanal seta $36\ \mu$. Peritreme extends beyond posterior margin of coxa I; anterior part of peritrematal shield fused with dorsal shield, posterior part fused with holovenal shield and with podal shield of coxa IV.

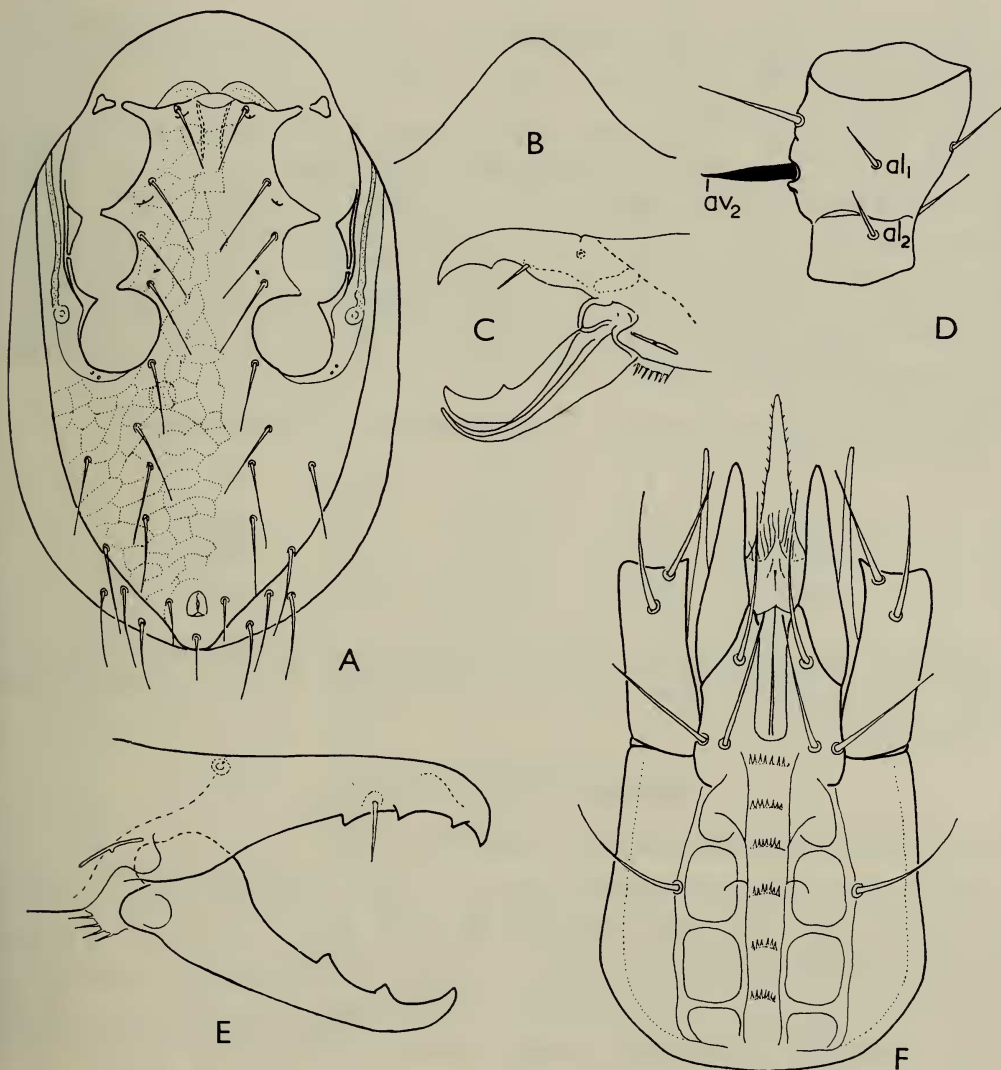


FIG. 23. *Hypoaspis nidicorva* sp. nov. A. Venter of idiosoma of male; B. tectum capituli of female; C. chelicera of male; D. femur II of male; E. chelicera of female; F. venter of gnathosoma of female.

Chaetotaxy of legs as in female. Femur II with seta *av*₂ very stout and spine-like (Text-fig. 23D). Length/width (in μ) of leg segments :

	I	II	III	IV
genu	63/27	60/36	40/22	60/20
tibia	70/24	50/33	40/24	63/22
tarsus	105/24	75/26	84/21	126/21

Deutonymph : Chelicera with segment I, 50 μ ; II, 156 μ ; movable digit 60 μ . Gnathosoma generally as in female ; setae *c.s.* about 48 μ apart, *hyp*.2 about 36 μ apart ; corniculi 45 μ long.

Dorsal shield (444 $\mu \times$ 246 μ) with lateral incisions ; with 14 pairs of setae in the podonotal region, the *s* series and the humeral seta being on the striated cuticle ; opisthonotal region with the usual 17 pairs of setae and two accessory setae. Tritosternum with base 45 μ , laciniae 84 μ . Sternito-genital shield (246 $\mu \times$ 114 μ) with four pairs of setae and three pairs of pores ; between *st*₁, 70 μ ; between *st*₁ and *st*₃, 108 μ . Anal shield (66 $\mu \times$ 75 μ) triangular with maximum width (100 μ) at anterior margin ; paranal setae 24 μ , postanal seta 40 μ . Peritreme extends beyond posterior margin of coxa I ; peritrematal shield free anteriorly, posterior part not developed.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	70/30	63/42	45/27	63/27
tibia	72/30	54/40	45/30	63/27
tarsus	108/27	84/27	90/24	132/24

HABITAT : Nest of a Jackdaw, Wookey Hole, Somerset, Britain, collected by O. C. Lloyd, 11th September, 1957. Holotype female (1965 : 12 : 29 : 27), allotype male (1965 : 12 : 29 : 28).

Hypoaspis claviger (Berlese)

Laelaps claviger Berlese, 1883, *Acari, Myr. Scorp. Ital.* fasc. 4, no. 2.

Female : Chelicera with segment I, 60 μ ; II, 156 μ ; movable digit 60 μ , bidentate ; fixed digit with four teeth (Text-fig. 24G) ; pilus dentilis short, setiform. Four pairs of gnathosomal setae with *c.s.* about 57 μ apart, *hyp*.2 about 42 μ apart. Deutosternum with six transverse rows of denticles (2-6 per row) ; corniculi 50 μ long ; internal malae branched (Evans & Till, 1965 ; Text-fig. 4A). Tectum capituli with denticulate anterior margin. Salivary stylus reaches tip of corniculus. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (654 $\mu \times$ 366 μ) with the normal 39 pairs of setae and four unpaired accessory setae, all spatulate in shape (Text-fig. 24C) and arranged as in Text-fig. 24A. Surface of shield reticulate ; seven pairs of *R* setae on the cuticle.

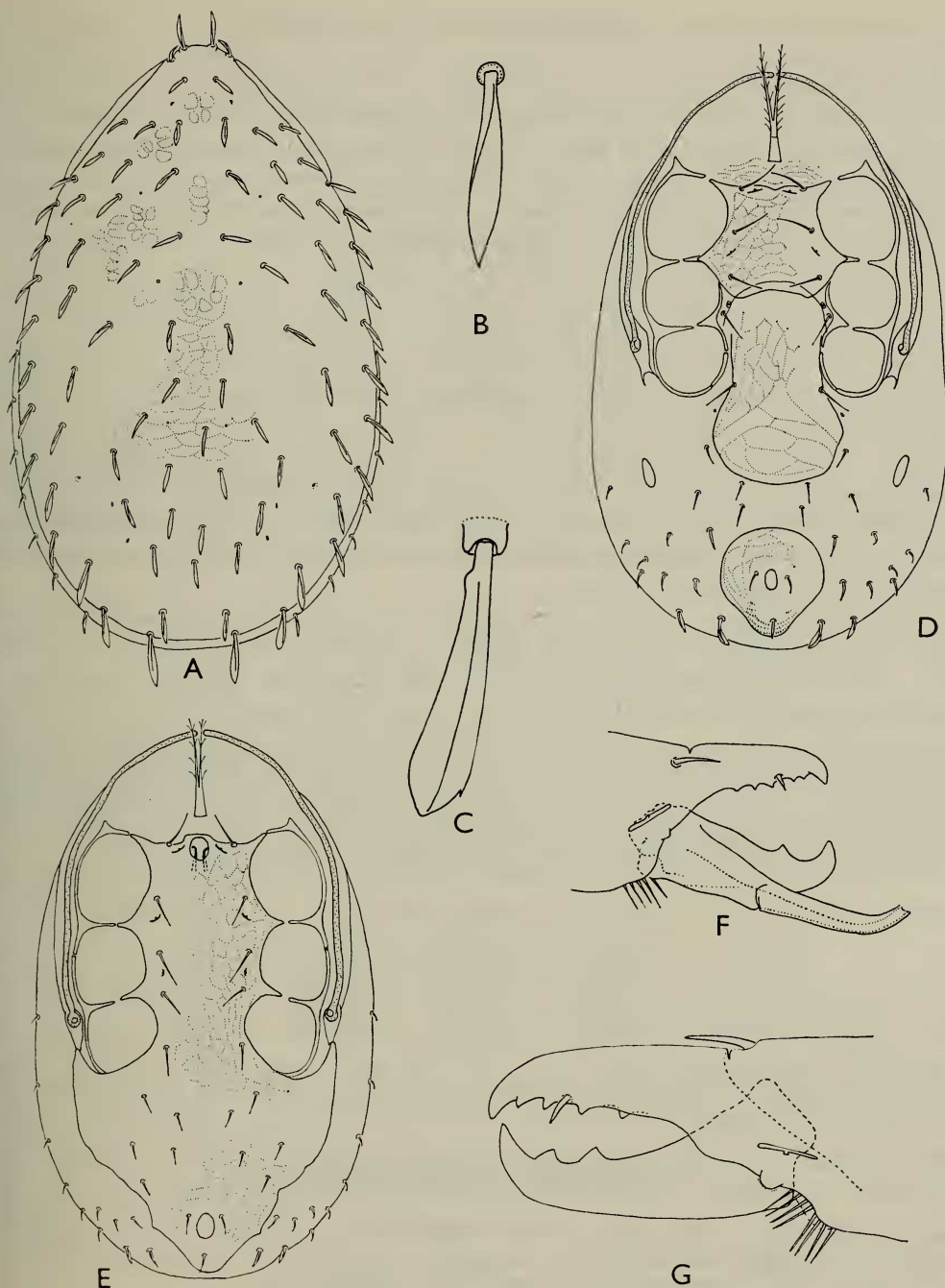


FIG. 24. *Hypoaspis claviger* (Berlese). A. Dorsum of idiosoma of female; B. dorsal seta J₄ of female; C. dorsal seta Z₅ of female; D. venter of idiosoma of female; E. venter of idiosoma of male; F. chelicera of male; G. chelicera of female.

Tritosternum with base $45\ \mu$, laciniae $80\ \mu$. Sternal shield ($110\ \mu \times 110\ \mu$) with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st*1, about $70\ \mu$; between *st*1 and *st*3, $102\ \mu$. Genital shield flask-shaped ($105\ \mu \times 102\ \mu$), with one pair of setae. Anal shield ($102\ \mu \times 114\ \mu$) with paranal and postanal setae about $20\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 24D. Peritremes reach midpoint at anterior end of idiosoma; peritrematal shields free anteriorly, posterior part fused with podal elements of coxa IV.

Legs with normal chaetotaxy. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	100/40	80/50	63/45	87/45
tibia	100/33	70/48	60/45	90/48
tarsus	153/27	138/40	140/36	216/36

Male: Chelicera with segment I, $42\ \mu$; II, $108\ \mu$; movable digit $40\ \mu$, unidentate; spermadactyl as in Text-fig. 24F; fixed digit bidentate. Four pairs of gnathosomal setae with c.s. about $48\ \mu$ apart, *hyp.* 2 about $36\ \mu$ apart. Deutosternum with six transverse rows of denticles (2–5 per row); corniculi $36\ \mu$ long. Other gnathosomal features as in female.

Dorsal shield ($486\ \mu \times 282\ \mu$) with 39 pairs of setae and five unpaired accessory setae; seven pairs of *R* setae on the cuticle. Tritosternum with base $30\ \mu$, laciniae $60\ \mu$. Holoventral shield ($360\ \mu \times 96\ \mu$) with three pairs of sternal, one pair of metasternal setae and three pairs of pores in the sternal region; between *st*1, $54\ \mu$; between *st*1 and *st*3, $93\ \mu$. Genito-ventral region with six pairs of setae; paranal setae $18\ \mu$, postanal seta $15\ \mu$. Chaetotaxy of opisthogaster, including *R* series, as in Text-fig. 24E. Peritremes reach mid-anterior point of idiosoma; peritrematal shields fused anteriorly with dorsal shield, posteriorly with holoventral shield.

Legs with normal chaetotaxy. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	80/36	63/42	50/36	78/40
tibia	80/30	56/40	48/36	80/36
tarsus	135/24	117/30	120/30	170/33

HABITAT: Probably predacious, living in soil, litter and rotting wood. Recorded from Britain and Europe.

Hypoaspis cuneifer (Michael)

Laelaps cuneifer Michael, 1891, *Proc. zool. Soc. Lond.*: 647.

Laelaps (*Cosmolaelaps*) *cuneifer*: Berlese, 1904, *Redia* 1: 416, pl. 15, figs. 123–124, pl. 16, fig. 125.

Cosmolaelaps cuneifer: Bregetova, 1956, *Opred. Faune SSSR*. 61: 75.

Female: Chelicera with segment I, $78\ \mu$; II, $234\ \mu$; movable digit $84\ \mu$, bidentate; fixed digit with about seven teeth, pilus dentilis short, setiform (Text-fig. 25F).

Four pairs of gnathosomal setae with *c.s.* about $90\ \mu$ and *hyp.2* about $72\ \mu$ apart. Deutosternum with six transverse rows of denticles; corniculi $50\ \mu$ long; internal malae with long slender filaments as in Text-fig. 25H. Tectum capituli with denticulate anterior margin (Text-fig. 25D). Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield ($804\ \mu \times 684\ \mu$) with the normal 39 pairs of setae plus 14 unpaired accessory setae; all except setae *r1* and *S2* are cuneiform (Text-fig. 25A and C). Surface of shield with reticulations consisting of rows of tiny spine-like markings.

Tritosternum with base $54\ \mu$, laciniae $123\ \mu$. Sternal shield ($168\ \mu \times 162\ \mu$) with two pairs of setae and one pair of pores; first pair of setae and pores situated on granular presternal area. Metasternals free with associated pores. Between *st1*, $72\ \mu$; between *st1* and *st3*, $153\ \mu$. Genital shield ($168\ \mu \times 204\ \mu$) expanded behind genital setae. Anal shield ($114\ \mu \times 126\ \mu$) with paranal and postanal setae subequal, $24\text{--}30\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 25B. Peritreme extends to middle of coxa I; peritrematal shield fused anteriorly with dorsal shield, posterior part free.

Chaetotaxy of legs differs from normal pattern in having two postero-lateral setae on genu IV ($2\text{--}\frac{2}{1}, \frac{3}{0}\text{--}2$). Most leg setae simple, some dorsal setae (on femora and trochanters) spatulate. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	132/54	108/66	90/54	138/57
tibia	150/45	96/66	90/54	138/54
tarsus	234/42	180/50	186/45	270/42

Male: Chelicera with segment I, $70\ \mu$; II, $192\ \mu$; movable digit $66\ \mu$ ($84\ \mu$ with spermadactyl), unidentate; fixed digit with four distinct teeth and a row of fine serrations. Four pairs of gnathosomal setae with *c.s.* about $75\ \mu$ and *hyp.2* about $66\ \mu$ apart. Corniculi $45\ \mu$ long; deutosternum, internal malae, tectum and pedipalps as in female.

Dorsal shield ($636\ \mu \times 546\ \mu$) with the normal 39 pairs of setae as well as unpaired accessory setae. Surface of shield patterned as in female.

Tritosternum with laciniae approximately three times as long as the base. Holoventral shield ($492\ \mu \times 147\ \mu$) with four pairs of setae and three pairs of pores in the sternal region, five pairs of setae in the genito-ventral region (Text-fig. 25E). Between *st1*, $84\ \mu$; between *st1* and *st3*, $123\ \mu$. Par- and postanal setae subequal in length, about $30\ \mu$. Peritreme extends to middle of coxa I; peritrematal shield fused anteriorly with dorsal shield, posterior part free.

Chaetotaxy of legs as in female. In addition, seta *av*₁ on femur II is large and spine-like (Text-fig. 25G); setae *av* on genu and tibia II are considerably stouter than setae *pv*. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	120/48	96/57	78/48	120/54
tibia	120/42	78/54	72/45	120/48
tarsus	198/36	120/42	132/36	198/42

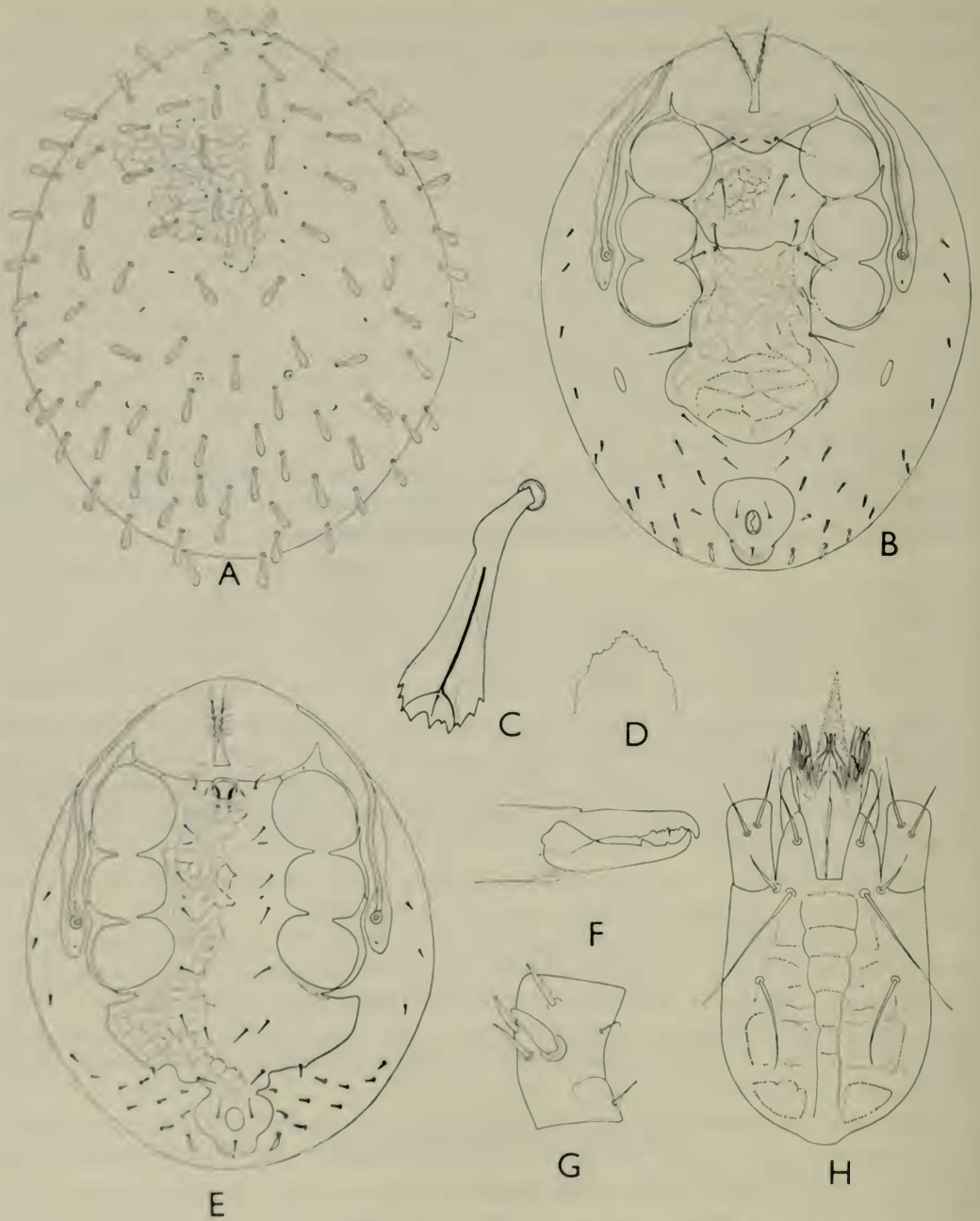


FIG. 25. *Hypoaspis cuneifer* (Michael). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. dorsal seta z6 of female; D. tectum capituli of female; E. venter of idiosoma of male; F. chelicera of female; G. femur II of male; H. venter of gnathosoma of female.

HABITAT: Myrmecophilous, associated with many ant hosts. Recorded from Europe, the U.S.S.R. and (?) Britain. We have included this species on the basis of the records given by Hull (1918) and by Turk (1953). It is possible that this species does not occur in Britain, but that its identity has been confused with that of *H. neocuneifer*.

Hypoaspis neocuneifer sp. nov.

Female: Chelicera with segment I, 75 μ ; II, 186 μ ; movable digit 66 μ , bidentate; fixed digit with from five to nine teeth; pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about 75 μ apart, *hyp.2* about 57 μ apart. Deutosternum with six transverse rows of small, fine denticles; corniculi 45 μ ; internal malae with long, slender filaments as in *H. cuneifer*. Tectum capituli with denticulate anterior margin. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (740 $\mu \times$ 528 μ) with the normal 39 pairs of setae and about nine unpaired accessory setae distributed as in Text-fig. 26A. Setae cuneiform in shape (Text-fig. 26D). Surface of shield with reticulations consisting of rows of tiny spine-like markings.

Tritosternum with base 45 μ , laciniae 110 μ . Sternal shield (117 $\mu \times$ 144 μ) with two pairs of setae and one pair of pores, the first pair of setae and pores being situated on the granular pre-sternal area. Metasternal setae free with associated pores. Between *st1*, 80 μ ; between *st1* and *st3*, 126 μ . Genital shield (123 $\mu \times$ 153 μ) flask-shaped, reticulated. Anal shield (110 $\mu \times$ 108 μ) with paranal setae simple, 27 μ long; postanal seta spatulate, 24 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 26B. Peritreme extends to about anterior third of coxa I; peritrematal shield fused anteriorly with dorsal shield, posterior part free.

Legs with normal chaetotaxy. Most leg setae simple, but rather short and spine-like, except at tip of tarsus I; some dorsal setae (on trochanters I, III, IV, and femora II-IV) spatulate. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	120/48	102/60	84/50	120/54
tibia	132/42	84/54	78/48	120/48
tarsus	186/36	144/45	156/42	225/42

Male: Chelicera with segment I, 50 μ ; II, 165 μ ; movable digit 58 μ , unidentate; spermadactyl 84 μ long from base of movable digit; fixed digit with about nine small teeth, pilus dentilis short, setiform (Text-fig. 26E). Four pairs of gnathosomal setae with c.s. about 63 μ apart, *hyp.2* about 50 μ apart. Corniculi 36 μ long; deutosternum, internal malae, tectum and pedipalps as in female.

Dorsal shield (624 $\mu \times$ 408 μ) with 39 pairs of setae and about nine unpaired accessory setae. Surface of shield as in female.

Tritosternum with base 33 μ , laciniae 90 μ . Venter bears a sternito-genito-ventral shield (336 $\mu \times$ 126 μ) and a separate anal shield (110 $\mu \times$ 96 μ); the former

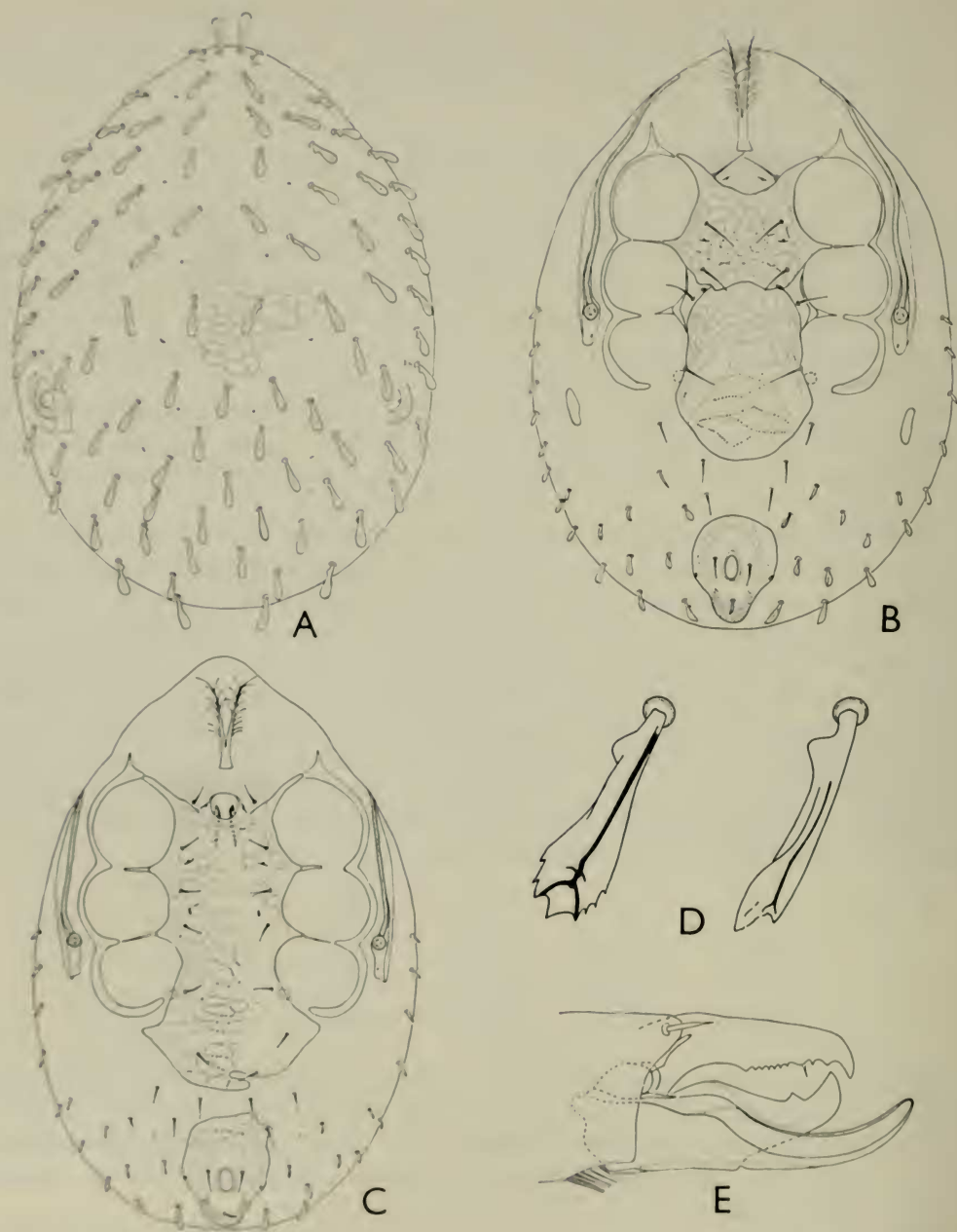


FIG. 26. *Hypoaspis neocuneifer* sp. nov. A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. venter of idiosoma of male; D. setae z_4 and z_6 of female; E. chelicera of male.

with four pairs of sternal setae and three pairs of pores, a pair of genital setae and three to five opisthogastric setae (Text-fig. 26c). Between $st1$, $70\ \mu$; between $st1$ and $st3$, $102\ \mu$. Paranal setae $24\ \mu$, postanal seta $18\ \mu$ long.

Chaetotaxy of legs and form of setae as in female; in addition, seta av_1 on femur II stout and spine-like. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	99/42	84/54	66/45	102/48
tibia	105/38	78/50	66/42	102/45
tarsus	150/33	114/42	126/40	186/38

HABITAT: Nests of *Formica rufa* Linn., White Hill Wood, Canterbury, 1st November, 1942 and 25th April, 1942. Holotype ♀ (1965: 12: 29: 23), allotype ♂ (1965: 12: 29: 24), four female paratypes. Ants' nest, White Hill, Canterbury, 18th October, 1941, one male, four female paratypes. Chip nest, same locality, 29th March, 1943, one female paratype. All specimens collected by Dr. E. Warren and deposited in the collection of the British Museum (Natural History).

It is possible that this species has been confused with *Hypoaspis cuneifer* (Michael). The specimens of *H. cuneifer* in the Donisthorpe collection are referable to the new species. We have not seen material of the true *H. cuneifer* in Britain.

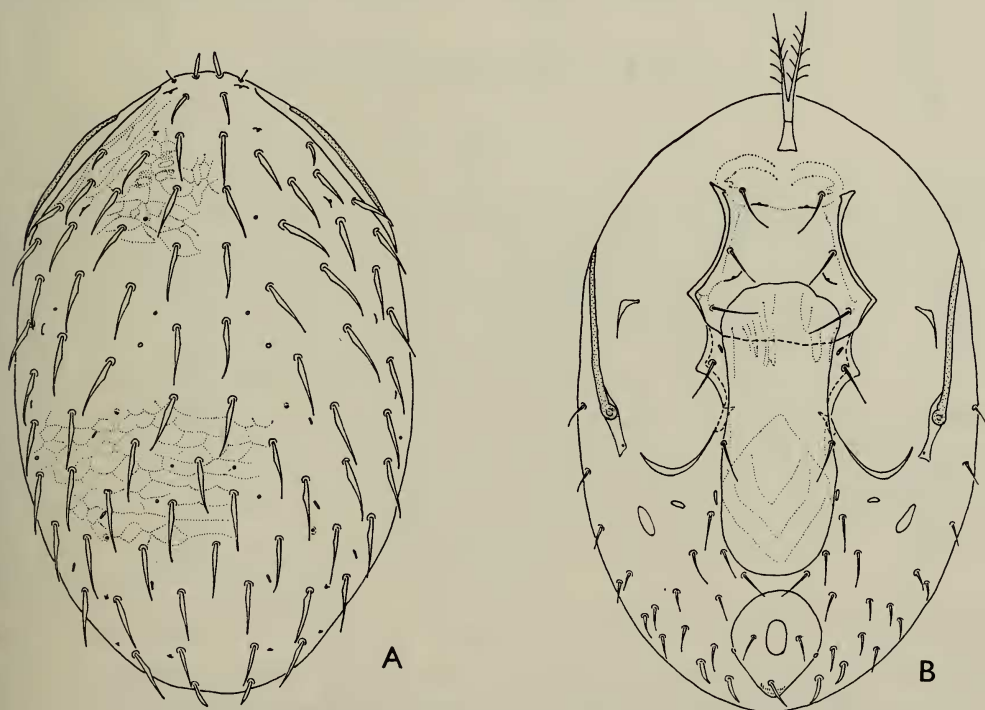


FIG. 27. *Hypoaspis vacua* (Michael), female; dorsum (A) and venter (B) of idiosoma.

Hypoaspis vacua (Michael)

Laelaps vacua Michael, 1891, *Proc. zool. Soc. Lond.* : 651, figs.

Laelaps (*Cosmolaelaps*) *vacuus*; Berlese, 1904, *Redia* 1 : 419, figs.

Laelaps (*Cosmolaelaps*) *vacuus* var. *ensiger* Berlese, 1904, *Redia* 1 : 420, figs.

Female : Chelicera with segment I, $33\ \mu$; II, $96\ \mu$; movable digit $33\ \mu$, bidentate ; fixed digit with five teeth, pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about $50\ \mu$ apart, *hyp.2* about $36\ \mu$ apart. Deutosternum with 6 or 7 transverse rows of denticles ; corniculi $27\ \mu$ long ; internal malae difficult to discern, but appear to consist of at least two pairs of delicate filaments. Tectum capituli with denticulate anterior margin. Salivary styli slender, reaching to tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield ($420\ \mu \times 264\ \mu$) with the normal 39 pairs of setae and two unpaired accessory setae distributed as in Text-fig. 27A. All the setae except *z1* are scimitar-like. Surface of shield reticulate.

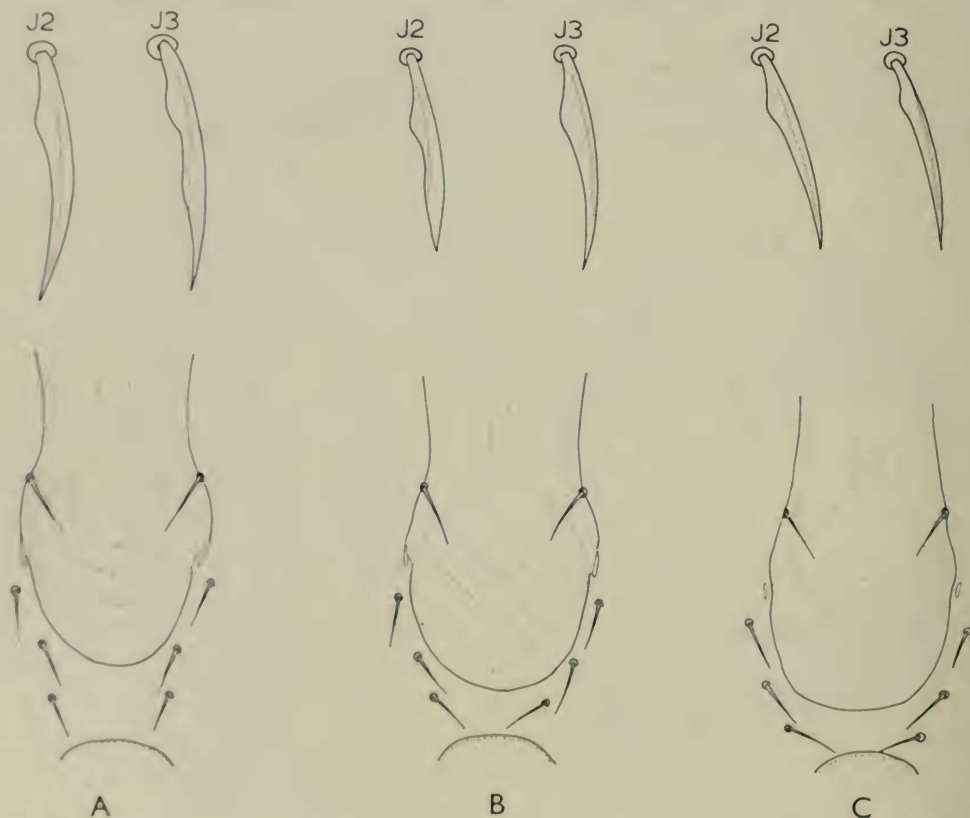


FIG. 28. *Hypoaspis vacua* (Michael), female. Variation in the form of dorsal setae *J2* and *J3* and of the genital shield in (A), the type specimen from Igls (Austria) ; in (B), a specimen from Eire, and in (C), a specimen from Sussex (England).

Tritosternum with base $30\ \mu$, laciniae $72\ \mu$. Sternal shield ($93\ \mu \times 90\ \mu$) with anterior margin extremely indistinct, bearing three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st*1, $54\ \mu$; between *st*1 and *st*3, $70\ \mu$. Genital shield ($90\ \mu \times 78\ \mu$) with lateral margins almost parallel; bearing genital setae only. Anal shield ($66\ \mu \times 63\ \mu$) with paranal setae $18\ \mu$ long, postanal seta $21\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 27B. Peritremes extend to middle of coxa I; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

In the limited material of this species which we have examined there appears to be considerable intraspecific variation in the length of the dorsal setae and in the form of the genital shield (Text-figs. 28A-C).

Legs with normal chaetotaxy. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	60/30	51/33	36/27	60/33
tibia	66/24	45/33	33/27	63/30
tarsus	117/24	84/27	72/24	111/27

HABITAT: Moss on tree stumps, Beckley, Sussex, 19th May, 1951; on Isle of Rhum, Scotland, July, 1964; ants' nest, Leigh-on-Sea, Essex, 14th May 1951; Mulranny, Eire, September, 1913; ants' nests in Austria and Italy.

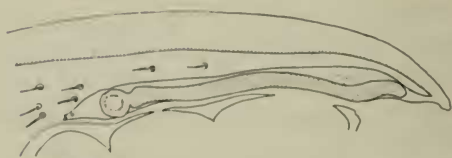
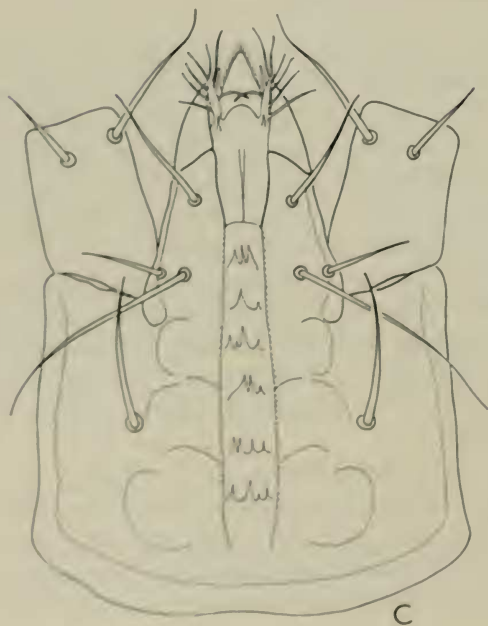
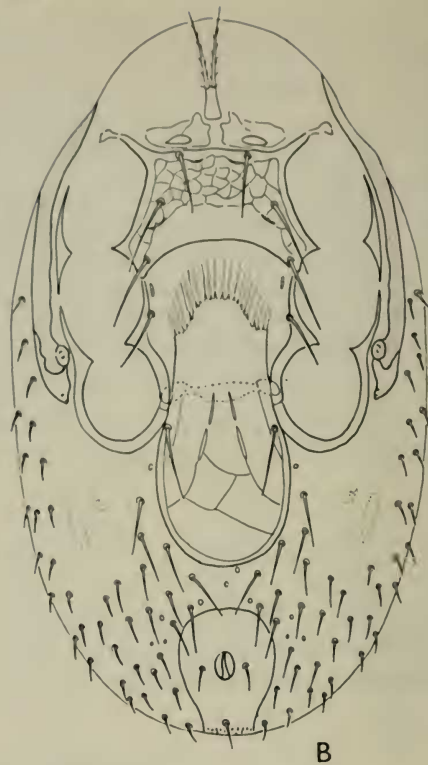
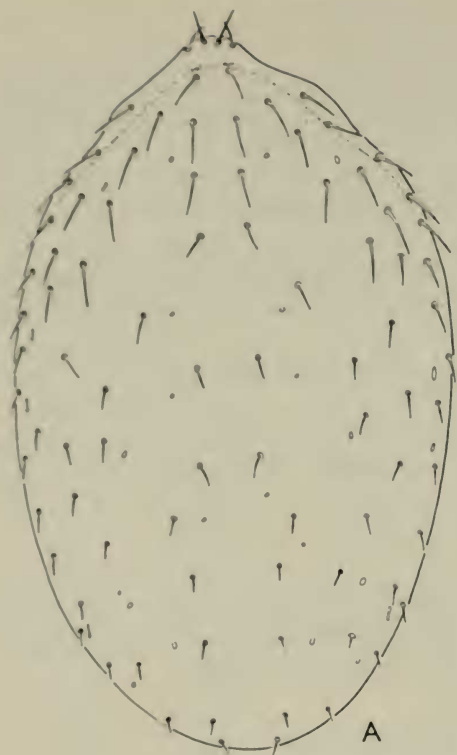
Hypoaspis bombicolens (Canestrini)

Iphis bombicolens Canestrini, 1884, *Prosp. Acarof. Ital.* (6) 2: 1634.

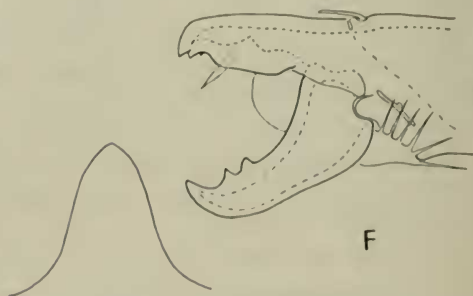
Female: Chelicera with segment I, $42\ \mu$; II, $108\ \mu$; movable digit $38\ \mu$, bidentate; fixed digit with one large and one small tooth, pilus dentilis short, setiform; dorsal seta short, slender (Text-fig. 29F). Four pairs of gnathosomal setae with *c.s.* about $54\ \mu$ apart, *hyp*.2 about $38\ \mu$ apart. Deutosternum with six transverse rows of denticles (2-4 per row); corniculi $27\ \mu$; internal malae as in Text-fig. 29C. Tectum capituli with smooth anterior margin (Text-fig. 29E). Salivary styli slender, nearly reaching tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield ($672\ \mu \times 384\ \mu$) with at least 40 pairs of setae, *px*1 being present on the opisthonotal part (in the specimen figured seta *px*3 is missing on one side). In addition, a variable number of marginal setae are included on both the podonotal and opisthonotal regions of the shield (Text-fig. 29A). Several anterior setae of the *j*, *z*, *s* and *r* series are considerably longer than the remaining setae. Surface of shield granular and reticulate; no hypertrichy.

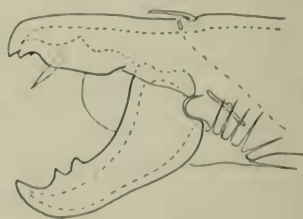
Tritosternum with base $24\ \mu$, laciniae $81\ \mu$. Sternal shield ($84\ \mu \times 138\ \mu$) with three pairs of setae and two pairs of pores, metasternal setae free with associated pores. Between *st*1, $87\ \mu$; between *st*1 and *st*3, $99\ \mu$. Genital shield ($120\ \mu \times 105\ \mu$) with genital setae only. Anal shield ($96\ \mu \times 70\ \mu$) with paranal setae $18\ \mu$, postanal seta $21\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 29B.



D



E



F

Peritreme extends to anterior third of coxa I; peritrematal shield fused anteriorly with dorsal shield (Text-fig. 29D); posterior part free.

Chaetotaxy of legs differs from normal pattern in that genu IV has two ventral setae ($2-\frac{2}{1}, \frac{3}{1}-1$). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	75/45	75/57	50/48	72/45
tibia	50/40	66/50	54/42	75/40
tarsus	132/36	102/40	120/36	144/33

HABITAT: Recorded from *Bombus terrestris* (Linn.) in Essex, Britain, and from *Bombus* sp. in Italy.

Hypoaspis breviseta sp. nov.

Female: Chelicera with segment I about 50 μ ; II, 120 μ . Structural details are not visible as the chelicerae are retracted. Four pairs of gnathosomal setae with c.s. about 60 μ apart, *hyp.2* about 45 μ apart. Deutosternum with six transverse rows of denticles (1-6 per row); corniculi 30 μ ; internal malae similar to those of *H. bombicolens*, but with the addition of a pair of slender, inner processes. Tectum capituli with smooth anterior margin. Salivary styli nearly reaching tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (744 $\mu \times$ 456 μ) with 42-44 pairs of setae distributed as in Text-fig. 30A. Setae *px1-3* are present in the opisthonotal region; additional marginal setae are present both in the podonotal and the opisthonotal region, but there are no accessories between the *J* series. The setae are short and simple, *ji* being relatively stout and *Z5* having the form indicated in Text-fig. 30B. Surface of shield granular.

Tritosternum with base 27 μ , laciniae 84 μ . Sternal shield (84 $\mu \times$ 150 μ) granular, reticulations very faint except in the antero-lateral corners; with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st1*, 75 μ ; between *st1* and *st3*, 102 μ . Genital shield (144 $\mu \times$ 150 μ) granular, with genital setae only. Anal shield (123 $\mu \times$ 108 μ) granular; paranal setae 30 μ long, postanal seta broken. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 30C. Peritreme extends to middle of coxa I; peritrematal shield fused anteriorly with dorsal shield; posterior part free.

Chaetotaxy of legs differs from free-living pattern in that genu IV bears two ventral setae (*pv* present). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	78/48	75/66	66/54	90/54
tibia	87/42	72/57	66/48	87/48
tarsus	138/40	120/42	130/40	150/40

FIG. 29. *Hypoaspis bombicolens* (Canestrini), female; dorsum of idiosoma (A); venter of idiosoma (B); venter of gnathosoma (C); peritreme and peritrematal shield (D); tectum capituli (E); chelicera (F).

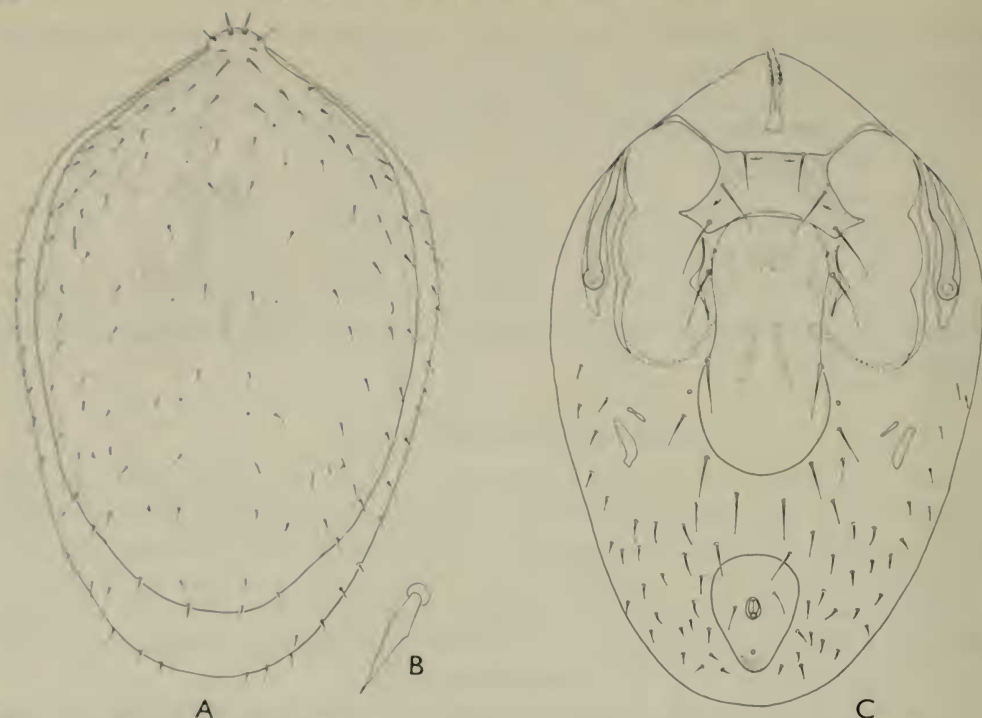


FIG. 30. *Hypoaspis breviseta* sp. nov., female; dorsum of idiosoma (A); seta Z5 (B); venter of idiosoma (C).

HABITAT: On *Bombus muscorum* (Linn.), Scarborough, Yorkshire, October, 1964. Holotype ♀ (1965: 12: 29: 26) in the collection of the British Museum (Natural History).

***Hypoaspis colomboi* sp. nov.**

Female: Chelicera with segment I, $54\ \mu$; II, $126\ \mu$; movable digit $45\ \mu$, bidentate; fixed digit unidentate, pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about $60\ \mu$ apart, *hyp.2* about $40\ \mu$ apart. Deutosternum with six transverse rows of denticles; corniculi $40\ \mu$ long; internal malae with fringed, elongate, inner lobe and fimbriate outer lobe. Tectum capituli with anterior margin smooth, slightly scalloped. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield ($600\ \mu \times 336\ \mu$) with 38 pairs of setae, *px2* missing (Text-fig. 31A). Surface of shield granular, no hypertrichy; marginal cuticle densely setose.

Tritosternum with base about $24\ \mu$, laciniae $80\ \mu$. Presternal area with a pair of pre-endopodal shields. Sternal shield ($135\ \mu \times 120\ \mu$) granular, thickened along lateral and anterior margins, with three pairs of setae and two pairs of pores; metasternal setae and their associated pores situated over the endopodal shields. Between *st1*, $63\ \mu$; between *st1* and *st3*, $105\ \mu$. Genital shield ($120\ \mu \times 138\ \mu$) with genital setae only. Anal shield ($80\ \mu \times 78\ \mu$) with maximum width $86\ \mu$; paranal setae

36 μ , postanal seta 30 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 31 B. Peritreme extends to about anterior third of coxa I. Peritrematal shield free posteriorly.

Chaetotaxy of legs differs from normal pattern in that genu IV has two ventral setae ($2-\frac{2}{1}$, $\frac{3}{1}-1$). Tarsus II with ventral setae and al_1 and pl_1 stout basally, tapering to fine points. Tarsus IV with ventral setae stout basally, tapering; seta pl_2 stout and spine-like. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	66/33	70/45	42/33	60/33
tibia	80/30	60/42	42/30	63/33
tarsus	130/28	98/33	105/27	135/27

Male: Chelicera with segment I, 45 μ ; II, 108 μ ; movable digit 36 μ (57 μ with spermadactyl), unidentate; fixed digit unidentate, pilus dentilis short, setiform. Four pairs of gnathosomal setae with *c.s.* about 54 μ apart; *hyp.2* about 42 μ apart; Deutosternum with six transverse rows of denticles; corniculi 36 μ ; internal malae triangular. Tectum capituli weakly dentate; pedipalp as in female.

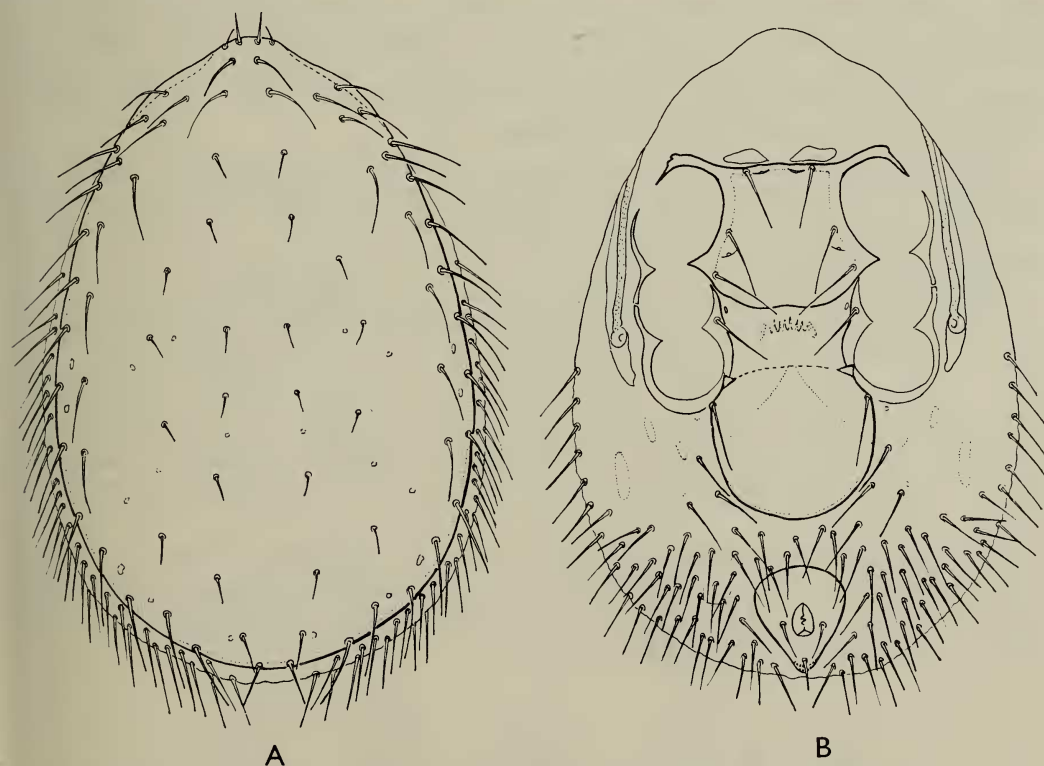


FIG. 31. *Hypoaspis colomboi* sp. nov., female; dorsum (A) and venter (B) of idiosoma.

Dorsal shield ($546 \mu \times 372 \mu$) as in female. Holovenal shield ($420 \mu \times 102 \mu$) granular with four pairs of setae and three pairs of pores in the sternal region, one pair of genitals, and about 26 opisthogastric setae (Text-fig. 32D). Between *st*1, 68μ ; between *st*1 and *st*3, 96μ . Paranal setae 42μ , postanal seta 33μ . Peritreme extends to anterior fourth of coxa I; posterior part of peritrematal shield free.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	60/32	63/45	40/27	54/30
tibia	70/27	54/40	42/27	57/27
tarsus	117/27	84/30	84/24	110/24

HABITAT: In nest of *Bombus lapidarius* (Linn.), Langley Park, Buckinghamshire (K.F. Colombo, 1961). Holotype ♀ (1965: 12: 29: 1), allotype ♂ (1965: 12: 29: 2).

Hypoaspis fuscicolens Oudemans

Hypoaspis fuscicolens Oudemans, 1902, *Tijdschr. ned. dierk. Ver.* (2) 7: 289 (nom. nud.); 1904, *Abh. nat. ver. Bremen* 18: 83, pl. 4, figs. 23-28.

Female: Chelicerae retracted, details of their structure not clearly visible. Four pairs of gnathosomal setae with *c.s.* very stout and about 72μ apart, *hyp*.2 about 48μ apart (Text-fig. 32B). Deutosternum with six transverse rows of denticles (2 to about 8 per row); corniculi 45μ ; internal malae triangular, fringed. Tectum capituli subtriangular with a minute antero-median projection, margin smooth. Pedipalp (2-5-6-14) with three-tined apotele.

Dorsal shield ($720 \mu \times 480 \mu$) with 24 pairs of setae in the podonotal region, an extra pair of *r* setae being present on the margin and a pair of accessory setae between *j*6. Opisthonotal region of shield hypertrichous (Text-fig. 32A). Surface of shield granular and reticulate.

Tritosternum with base 45μ , laciniae 105μ . Sternal shield ($84 \mu \times 186 \mu$) with three pairs of setae and two pairs of pores, metasternal setae free with associated pores. Between *st*1, 75μ ; between *st*1 and *st*3, 105μ . Genital shield ($130 \mu \times 150 \mu$) with genital setae only. Anal shield ($132 \mu \times 108 \mu$) with par- and postanal setae about 24μ long. Chaetotaxy and sclerotization of venter as in Text-fig. 32C. Peritreme extends onto dorsum, terminating at a point over posterior margin of coxa I; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Chaetotaxy of legs differs from normal pattern in that genu IV has two ventral setae ($2-\frac{2}{1}, \frac{3}{1}-1$). Coxae I and II with very stout setae; genu and tibia II with *pu* stouter than *av*; tarsus II with seta *mv* short and stout. Ambulacrum I without claws. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	90/50	96/60	66/57	93/57
tibia	96/50	80/63	72/50	99/50
tarsus	140/48	126/50	140/48	168/45

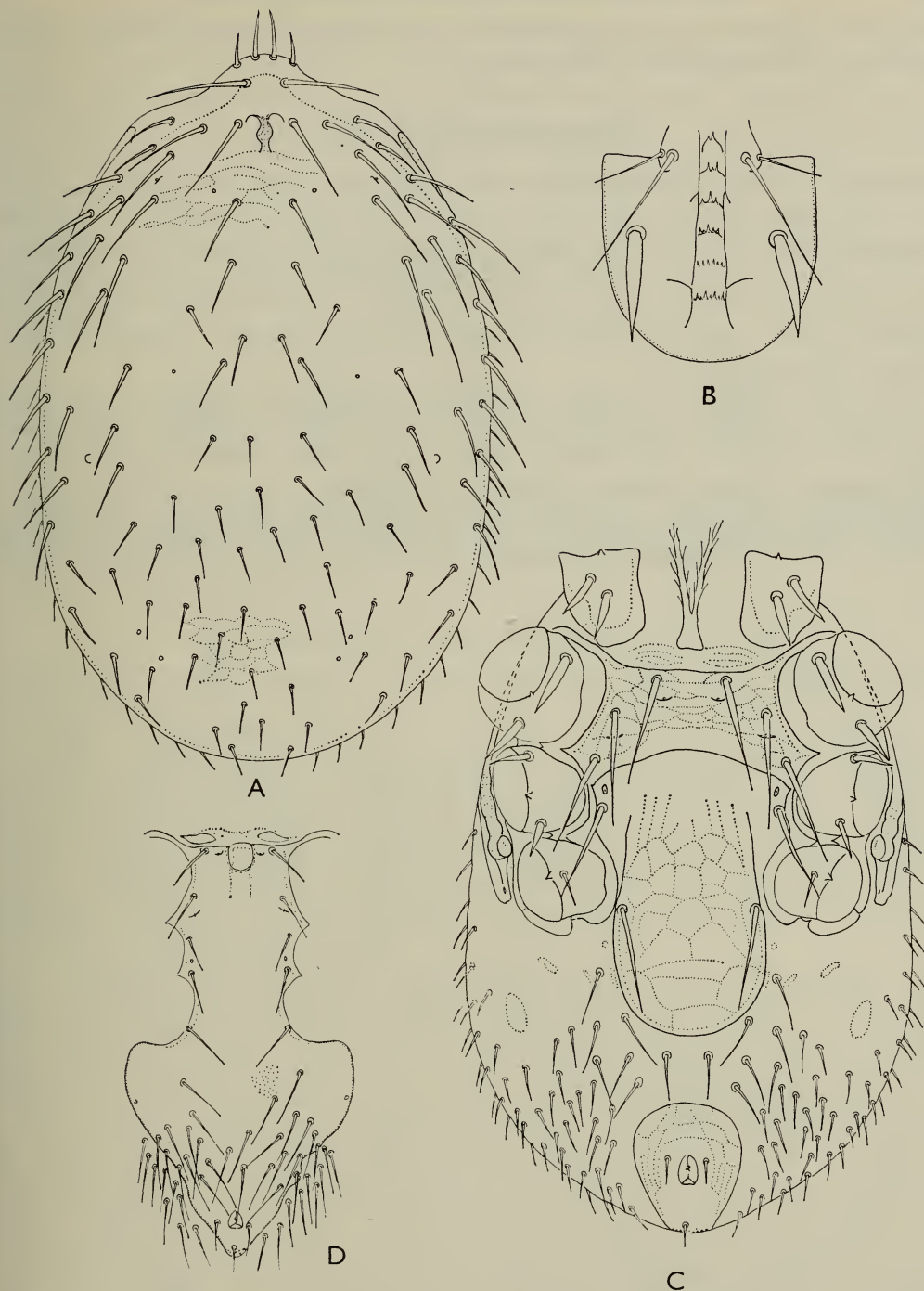


FIG. 32. A–C. *Hypoaspis fuscicolens* Oudemans, female; dorsum of idiosoma (A); basis capituli (B); venter of idiosoma (C). D. *Hypoaspis colomboi* sp. nov., male; holoventral shield.

HABITAT: Found with several species of *Bombus* and with *Psithyrus vestalis* (Geoff.) on Wangeroog Island, Germany.

Hypoaspis hyatti sp. nov.

Female: Chelicera with segment I, $60\ \mu$; II, $120\ \mu$; movable digit $40\ \mu$, bidentate; fixed digit with one large and two minute teeth; pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about $57\ \mu$ apart; *hyp.2* about $42\ \mu$ apart. Deutosternum with six transverse rows of deutosternal teeth (2-6 per row); corniculi $33\ \mu$; internal malae as in *Hypoaspis bombicolens*. Tectum capituli with smooth anterior margin. Salivary styli reach almost to tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield ($612-642\ \mu \times 396-432\ \mu$) with 43-44 pairs of setae as well as about 16 unpaired accessory setae between the *J* series; *px1-3* present in opisthonotal region (Text-fig. 33A). Setae simple, slightly longer in the anterior than in the posterior region. Surface of shield granular and reticulate.

Tritosternum with base $30\ \mu$, laciniae $90\ \mu$. Sternal shield ($84-90\ \mu \times 132-140\ \mu$) granular and reticulate, with three pairs of setae and two pairs of pores; meta-

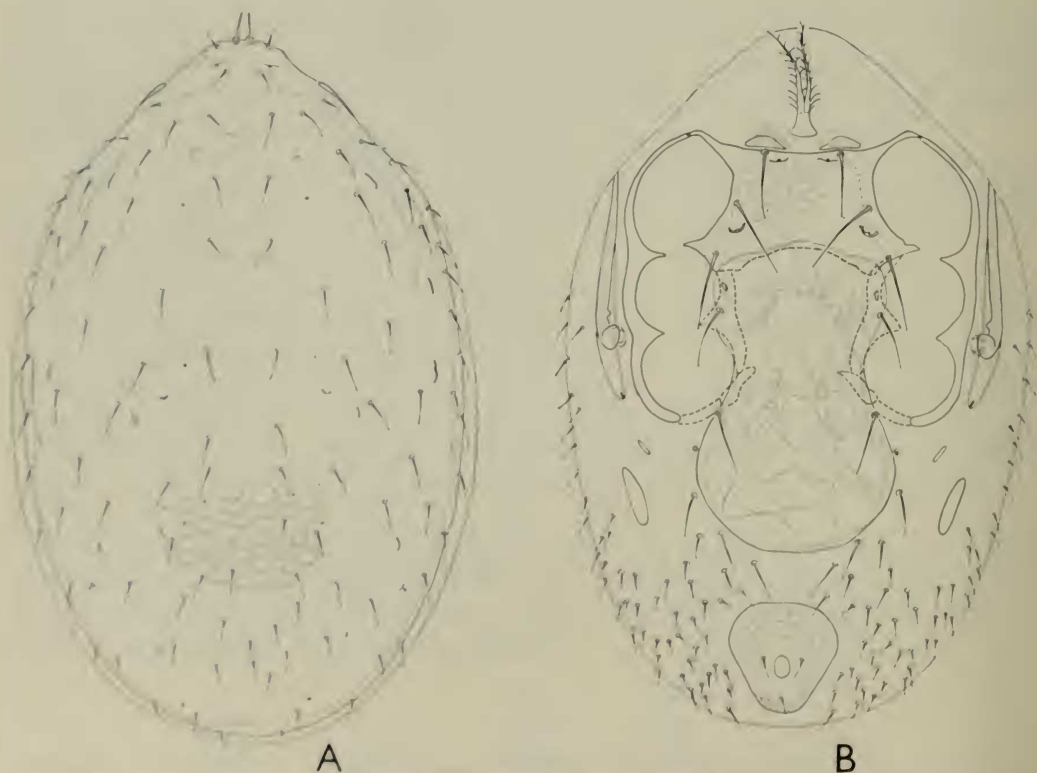


FIG. 33. *Hypoaspis hyatti* sp. nov., female; dorsum (A) and venter (B) of idiosoma.

sternal setae free with associated pores. Between *st*1, 72 μ ; between *st*1 and *st*3, 108 μ . A pair of well-defined pre-endopodal shields is situated in the pre-sternal region. Genital shield (130 $\mu \times$ 150 μ) with genital setae only. Anal shield (93 $\mu \times$ 84 μ) reticulate; par- and postanal setae about 20 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 33B. Peritreme extends to anterior third of coxa I; anterior part of peritrematal shield fused with dorsal shield; posterior part free.

Chaetotaxy of legs differs from the normal pattern in that genu IV bears two ventral setae (*pv* present). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	84/40	75/54	57/42	75/40
tibia	90/36	68/50	57/36	78/36
tarsus	140/33	110/36	117/33	150/33

HABITAT: On *Bombus muscorum* (Linn.), Scarborough, Yorkshire, October, 1964. Holotype ♀ (1965: 12: 29: 11) and twenty-two female paratypes (1965: 12: 29: 12-22) in the collection of the British Museum (Natural History).

Hypoaspis marginalis (Willmann)

Pneumolaelaps marginalis Willmann, 1953, *Sitz. Österr. Akad. Wiss. Abt. I*, **162** (6): 465, figs. 11-12.

Female: Chelicera with segment I, 48 μ ; II, 120 μ ; movable digit 42 μ , bidentate; fixed digit tridentate, pilus dentilis short, setiform (Text-fig. 34C). Four pairs of gnathosomal setae with *c.s.* about 63 μ apart, *hyp.2* about 48 μ apart. Deutosternum with six transverse rows of denticles (3-8 per row) (Text-fig. 34D); corniculi 30 μ ; internal malae with a pair of slender, triangular inner lobes and a pair of fimbriate outer lobes. Tectum capituli with anterior margin smooth. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (624 $\mu \times$ 408 μ) with 25 pairs of setae in the podonotal region, three pairs of *r* setae apart from the humerals being included on the shield (Text-fig. 34A). Opisthonotal region with 18 pairs of setae, *px*1 being present, and about 13 unpaired accessory setae between the *J* series. Setae near anterior tip of shield noticeably longer than those near posterior tip. Surface of shield granular and reticulate.

Tritosternum with base 33 μ , laciniae about 75 μ . Presternal area with a pair of pre-endopodal shields. Sternal shield (93 $\mu \times$ 144 μ) with three pairs of setae and two pairs of pores. Metasternal setae and associated pores situated over endopodal shields. Between *st*1, 66 μ ; between *st*1 and *st*3, 110 μ . Genital shield (110 $\mu \times$ 147 μ) with genital setae only. Anal shield (90 $\mu \times$ 90 μ) with paranal setae 21 μ , postanal seta 24 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 34B. Peritreme extends to anterior third of coxa I; posterior part of peritrematal shield free.

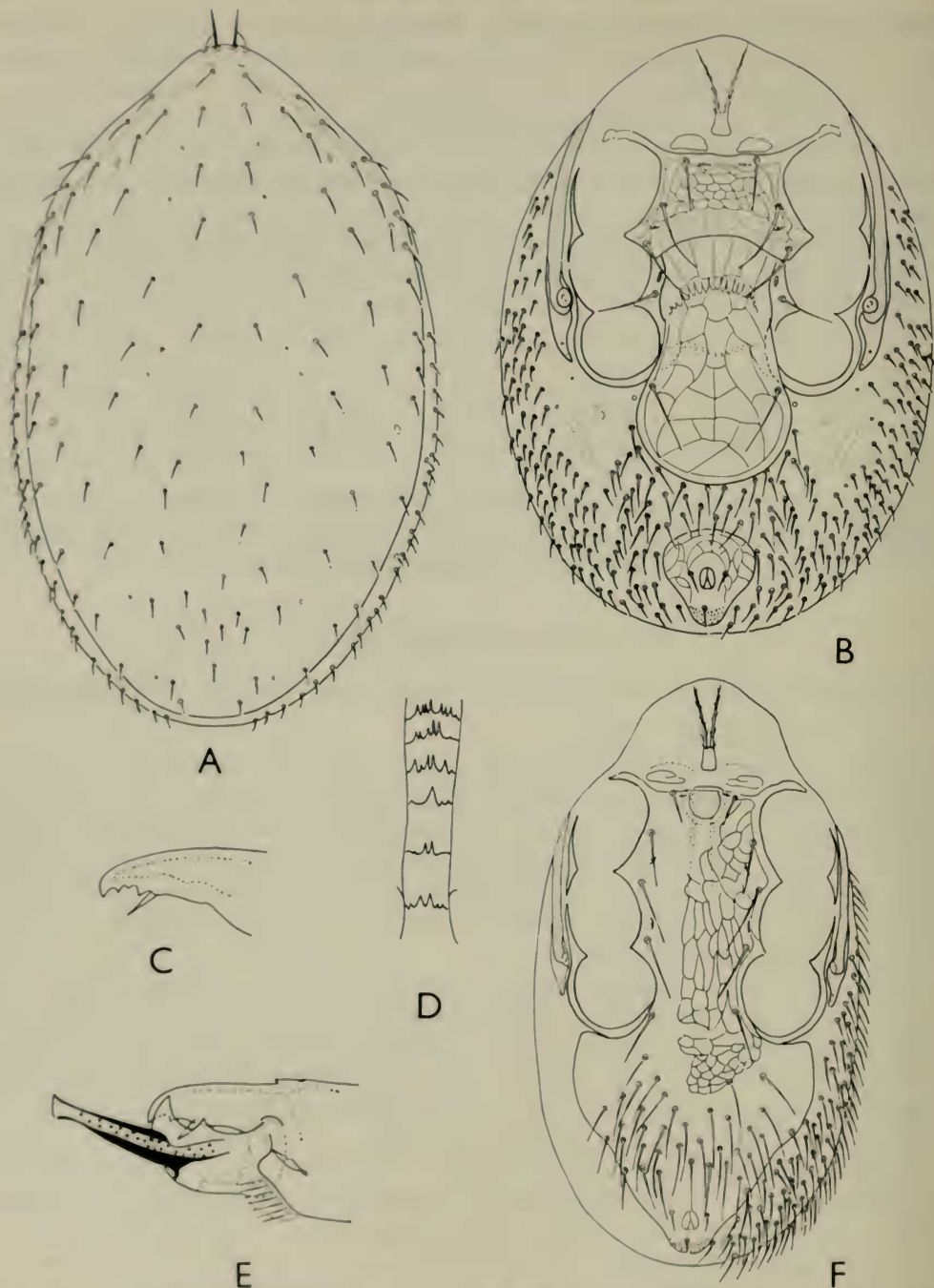


FIG. 34. *Hypoaspis marginalis* (Willmann). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. fixed digit of chelicera of female; D. deutosternum of female; E. chelicera of male; F. venter of idiosoma of male.

Chaetotaxy of legs differs from the normal pattern in that genu IV has two ventral setae ($2-\frac{2}{1}, \frac{3}{1}-1$). Tarsi II-IV with ventral setae stouter than the dorsals, tarsus IV with setae pl_{2-3} spine-like. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	78/40	75/57	60/44	78/42
tibia	84/36	66/50	57/40	78/38
tarsus	132/33	102/38	117/36	156/33

Male : Chelicera with segment I, 48 μ ; II, 110 μ ; movable digit 36 μ (57 μ with spermadactyl), unidentate ; fixed digit unidentate, pilus dentilis short, setiform (Text-fig. 34E) ; groove of spermadactyl granular. Four pairs of gnathosomal setae with c.s. about 60 μ apart, *hyp.2* about 42 μ apart. Deutosternum with six transverse rows of denticles (5-6 per row) ; corniculi 36 μ . Internal malae, tectum, capituli and pedipalps as in female.

Dorsal shield (576 $\mu \times$ 348 μ) with chaetotaxy as in female, but only about six accessory setae. Tritosternum with base 24 μ , laciniae 84 μ . Presternal area with a pair of pre-endopodal shields. Holoventral shield (456 $\mu \times$ 135 μ) with four pairs of setae and three pairs of pores in the sternal region, with a pair of genital setae and 37-44 opisthogastric setae in the genito-ventral region (Text-fig. 34F). Between *st1*, 66 μ ; between *st1* and *st3*, 102 μ . Peritreme extends to about middle of coxa I ; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Chaetotaxy of legs as in female. Femur II with seta *av*₁ very stout and spine-like ; genu II and tibia II with seta *av* strongly inflated basally ; tarsus II with setae *av*₁₋₂ and *mv* inflated basally, tapering to long fine points. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	78/36	78/60	60/42	78/42
tibia	84/36	66/54	54/36	72/36
tarsus	132/30	96/36	96/30	138/30

HABITAT : Found on *Bombus terrestris* (Linn.) in Essex, in the nest of *B. hortorum* (Linn.) in Hertfordshire, and on *Bombus mucidus* (Gerst.) in Austria.

Hypoaspis minutissima sp. nov.

Female : Chelicera with segment I, 42 μ ; II, 102 μ ; movable digit 36 μ , bidentate ; fixed digit with bifid tip and three small teeth, pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about 50 μ apart, *hyp.2* about 36 μ apart. Deutosternum with six transverse rows of denticles ; corniculi 42 μ ; internal malae slender, indistinct. Tectum capituli with anterior margin smooth. Pedipalp (2-5-6-14) with two-tined apotele.

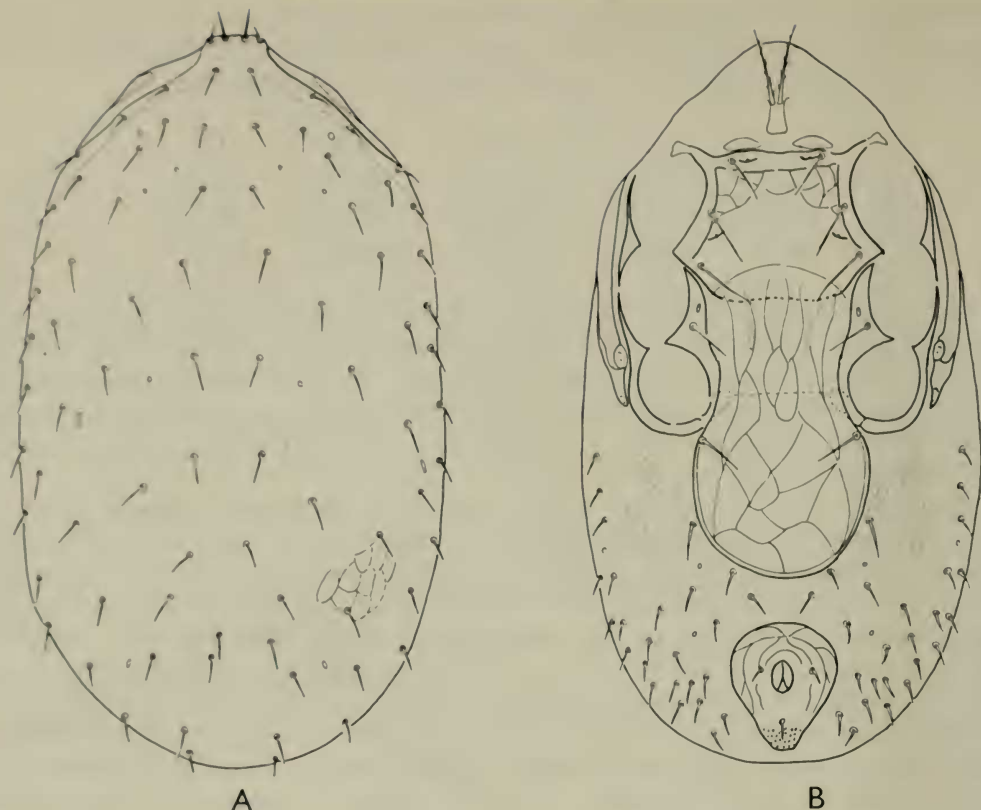


FIG. 35. *Hypoaspis minutissima* sp. nov., female; dorsum (A) and venter (B) of idiosoma.

Dorsal shield ($492\ \mu \times 312\ \mu$) with 39 pairs of setae and about five accessory setae between the *J* series (Text-fig. 35A). Setae simple, subequal. Surface of shield granular and reticulate.

Tritosternum with base $24\ \mu$, laciniae $84\ \mu$. Presternal area with a pair of pre-endopodal shields. Sternal shield ($105\ \mu \times 105\ \mu$) granular with faint reticulations, bearing three pairs of setae and two pairs of pores. Metasternal setae and associated pores situated over the endopodal shields. Between *st*1, $65\ \mu$; between *st*1 and *st*3, $80\ \mu$. Genital shield ($102\ \mu \times 114\ \mu$) with genital setae only. Anal shield ($60\ \mu \times 75\ \mu$) with paranal setae $15\ \mu$, postanal seta $18\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 35B. Peritreme extends to anterior third of coxa I; anterior tip of peritrematal shield fused with dorsal shield, posterior part free.

Chaetotaxy of legs differs from normal pattern in that genu IV bears two ventral setae. Tarsi II and IV with ventral setae relatively long, stout basally, tapering to fine points. Seta *pl*₂ on tarsus IV long, spine-like. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	60/30	60/36	42/27	54/27
tibia	72/27	50/33	42/24	54/24
tarsus	108/27	80/27	96/24	117/24

HABITAT: On a *Bombus terrestris* (Linn.) queen, Gosforth, Cumberland, Britain, collected by D. C. Lee, 3rd May, 1960. Holotype ♀ (1965 : 12 : 29 : 5) and paratype ♀ (1965 : 12 : 29 : 6).

Hypoaspis isotricha (Kolenati)

Holostaspis isotricha Kolenati, 1858, *Wien. Ent. Monatschr.* 2 : 87, figs.

Female: Chelicera with segment II, 66 μ ; movable digit 18 μ , with one minute, subterminal tooth; fixed digit with one small tooth; pilus dentilis very short and setiform (Text-fig. 36D). Four pairs of gnathosomal setae with *c.s.* about 50 μ apart, *hyp.2* about 36 μ apart. Deutosternum with six transverse rows of denticles; corniculi 18 μ long; internal malae as in Text-fig. 36E. Tectum capituli with smooth anterior margin (Text-fig. 36B). Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (612 $\mu \times$ 432 μ) with 39 pairs of setae and two unpaired accessory setae distributed as in Text-fig. 36A. All the setae except *j1* and *z1* are barbed (Text-fig. 36C). Surface of shield sculptured anteriorly, reticulate posteriorly.

Tritosternum with base 36 μ , laciniae about 72 μ . Sternal shield (96 $\mu \times$ 114 μ) with three pairs of setae and two pairs of pores; metasternal setae and pores situated over the endopodal shields. Between *st1*, 60 μ ; between *st1* and *st3*, 108 μ . Genital shield (168 $\mu \times$ 150 μ) with genital setae only. Anal shield (84 $\mu \times$ 80 μ) concave anteriorly; paranal setae 36 μ , postanal seta 60 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 36F. Peritreme extends approximately to anterior margin of coxa II; posterior part of peritrematal shield free.

Legs with normal chaetotaxy. Dorsal seta on trochanter I stout and spine-like; seta *ad*₁ on femora II-IV relatively stout and spine-like. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	63/24	42/40	45/35	60/32
tibia	68/18	45/33	42/30	57/27
tarsus	123/19	80/25	78/24	110/20

HABITAT: Ants' nests (*Formica* sp.) in the Black Wood of Rannoch, Perthshire, Scotland, and in Europe.

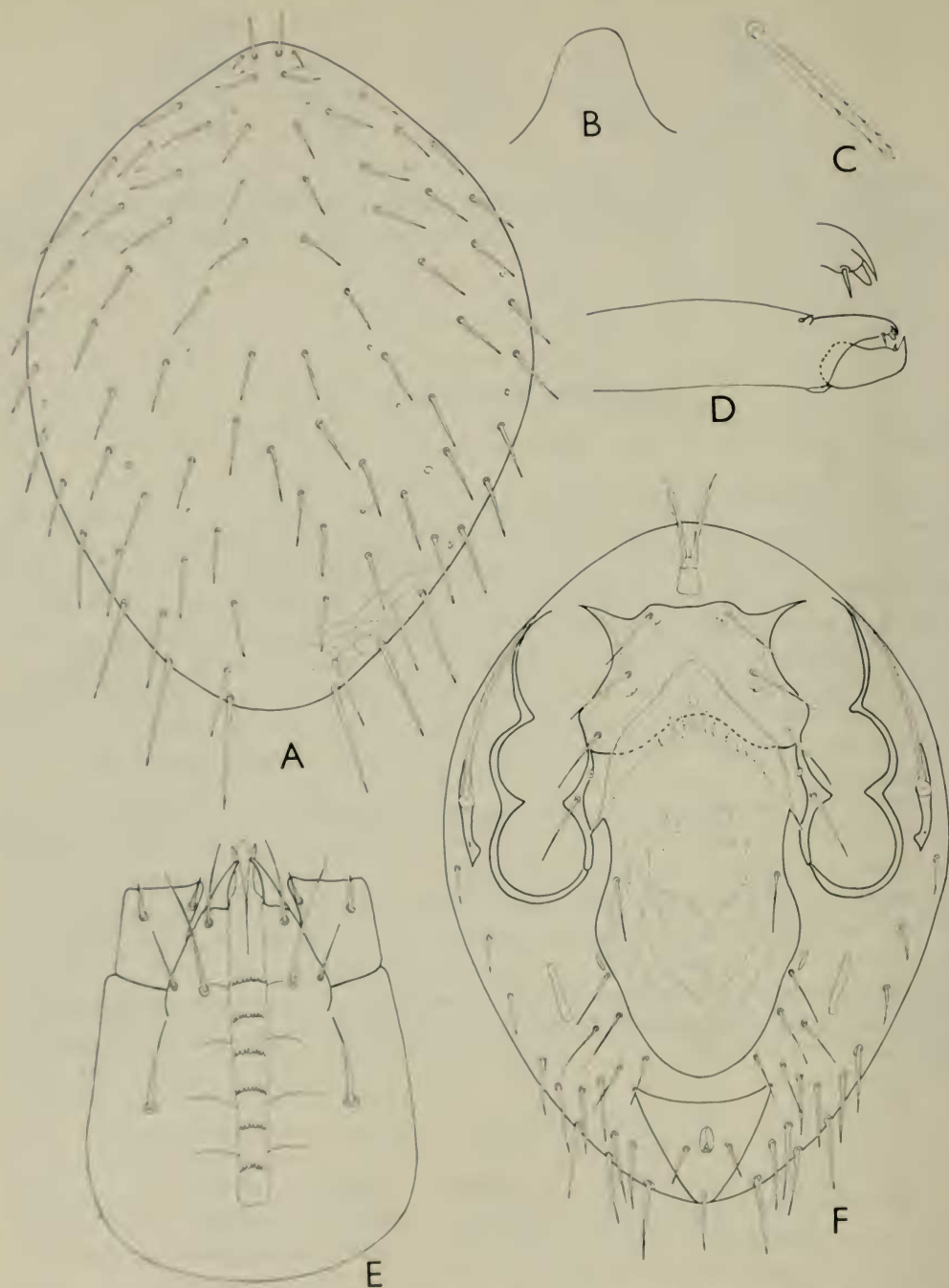


FIG. 36. *Hypoaspis isotricha* (Kolenti), female; dorsum of idiosoma (A); tectum (B); dorsal seta (c); chelicera (D); venter of gnathosoma (E); venter of idiosoma (F).

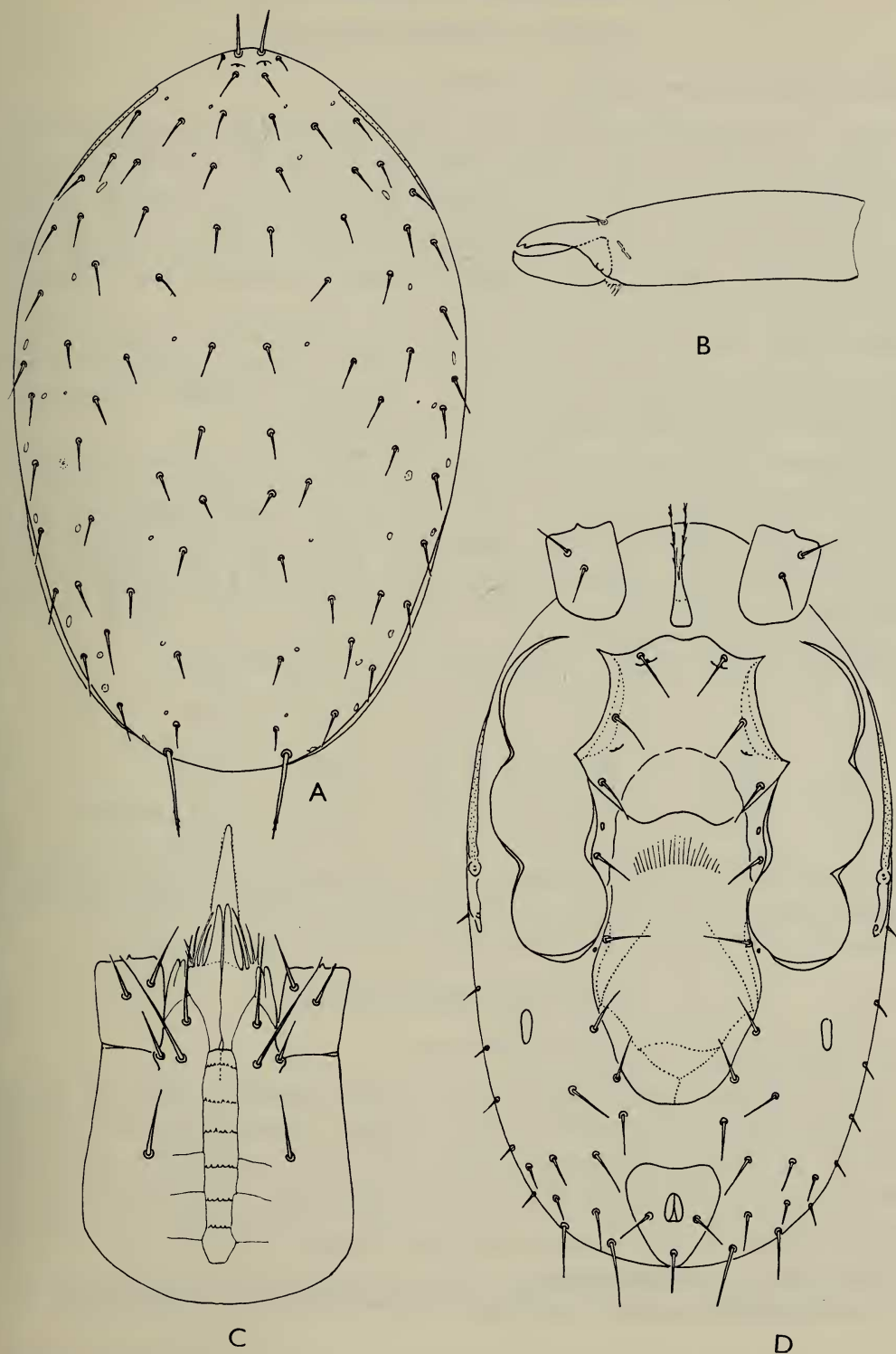


FIG. 37. *Hypoaspis montana* (Berlese), female; dorsum of idiosoma (A); chelicera (B); venter of gnathosoma (C); venter of idiosoma (D).

Hypoaspis montana (Berlese)

Laelaps (Oolaelaps) montanus Berlese, 1904, *Redia* 1: 430.

Female: Chelicera with segment I, 20 μ ; II, 75 μ ; movable digit 21 μ , edentate; fixed digit unidentate; pilus dentilis absent, dorsal seta and arthrodial processes present (Text-fig. 37B). Four pairs of gnathosomal setae with *c.s.* about 36 μ apart, *hyp.2* about 30 μ apart. Deutosternum with six transverse rows of denticles (4–8 denticles per row); corniculi horn-like, bifid at tip, about 20 μ long; internal malae fimbriate (Text-fig. 37C). Tectum capituli with anterior margin smooth. Pedipalp (2–5–6–14) with two-tined apotele.

Dorsal shield (468 $\mu \times$ 312 μ) with 39 pairs of setae distributed as in Text-fig. 37A; a pair of accessory setae situated between the *J* series. Setae *Z5* pilose distally and about three times the length of simple seta *J5*. Anterior part of shield "sculptured", reticulations and striations distinct only in the marginal zone.

Tritosternum with base 20 μ , laciniae 54 μ . Sternal shield (105 $\mu \times$ 100 μ) with weak striations laterally, bearing three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st1*, 50 μ ; between *st1* and *st3*, 87 μ . Genital shield (110 $\mu \times$ 95 μ) with genital setae only. Anal shield (60 $\mu \times$ 57 μ) with paranal setae 24 μ , postanal seta 30 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 37D. Peritremes extend to middle of coxa I; peritrematal shields free posteriorly.

Chaetotaxy of legs normal. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	63/30	51/36	42/28	60/30
tibia	70/30	45/33	40/26	60/28
tarsus	114/27	78/24	70/24	96/24 approx.

HABITAT: Ants' nest near Canterbury, Kent, 25th April, 1942, coll. Dr. E. Warren. Recorded from nests of *Formica rufa* Linn., *F. fusca* Linn. and *Lasius niger* (Linn.) in Britain and Ireland, and from ants' nests in Europe.

Hypoaspis oophila (Wasman)

Laelaps oophilus Wasman, 1897, *Zool. Anz.* 20: 172.

Female: Chelicera with movable digit 18 μ long, bidentate; fixed digit unidentate; pilus dentilis and dorsal seta short, setiform; arthrodial processes reduced (Text-fig. 38B). Four pairs of gnathosomal setae with *c.s.* about 54 μ apart, *hyp.2* about 42 μ apart. Deutosternum with six transverse rows of denticles (5–7 denticles per row); corniculi horn-like, 21 μ long; internal malae weakly serrate basally (Text-fig. 38D). Tectum capituli with smooth margin (Text-fig. 38C). Pedipalp (2–5–6–14) with two-tined apotele.

Dorsal shield (600 $\mu \times$ 438 μ) with 39 pairs of setae distributed as in Text-fig. 38A;

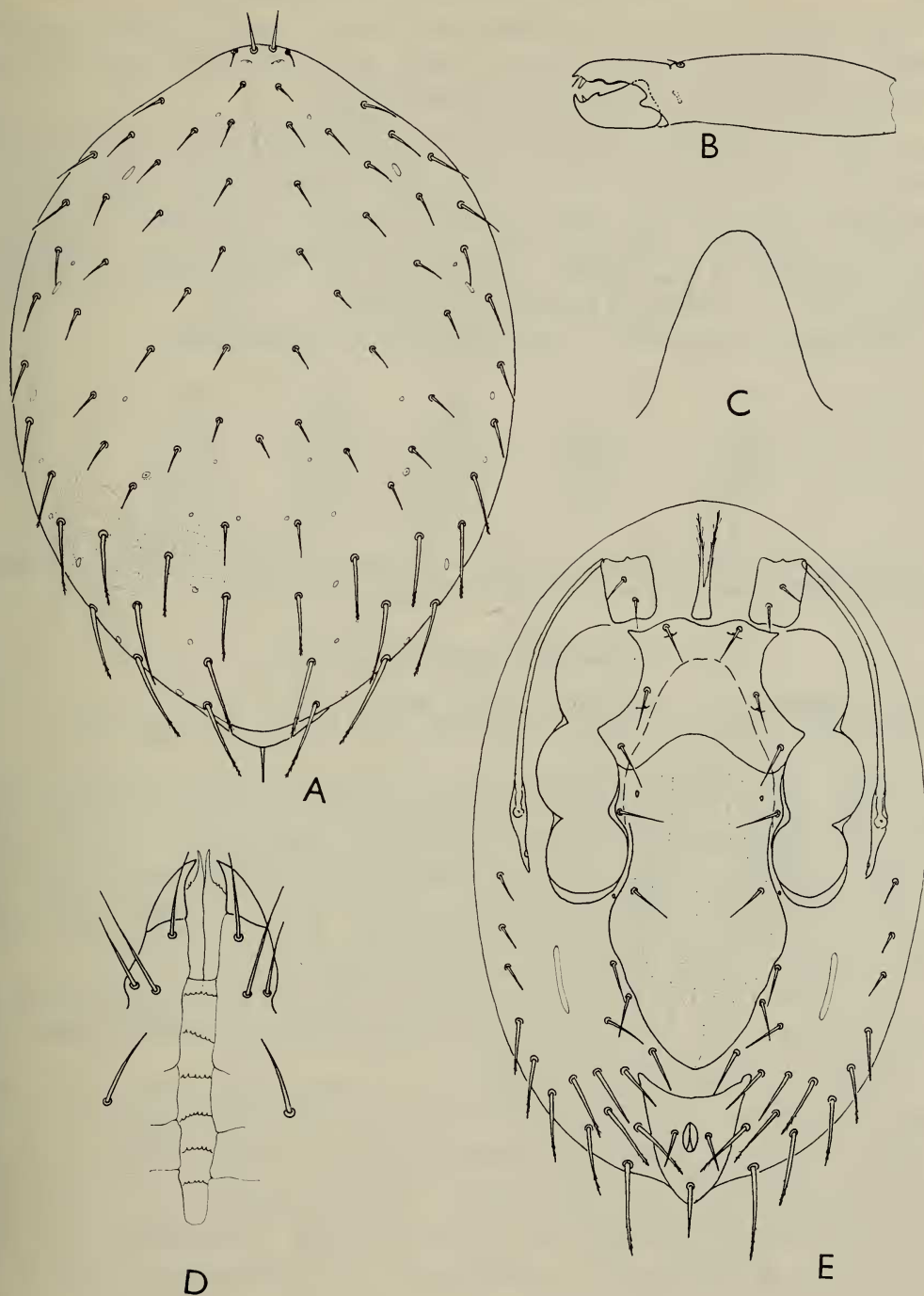


FIG. 38. *Hypoaspis oophila* (Wasman), female; dorsum of idiosoma (A); chelicera (B); tectum capituli (C); deutosternum and hypostome (D); venter of idiosoma (E).

a single accessory seta present between the *J* series. Setae markedly unequal in length; *J*₄₋₅, *Z*₃₋₅ and *S*₂₋₅ pilose distally and considerably longer than the remaining simple setae. Surface of shield reticulated.

Tritosternum with base 36 μ , laciniae 60 μ . Sternal shield (102 $\mu \times$ 117 μ) with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st*₁, 66 μ ; between *st*₁ and *st*₃, 110 μ . Genital shield (153 $\mu \times$ 140 μ) tapers posteriorly and bears a pair of genital setae only. Anal shield (80 $\mu \times$ 72 μ ; maximum width 96 μ) with paranal setae 33 μ , postanal seta 48 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 38E. Peritremes extend to a point above coxae I; peritrematal shields free posteriorly.

Chaetotaxy of legs normal. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	54/21	40/45	38/42	48/36
tibia	60/18	36/33	33/38	48/30
tarsus	108/21	80/24	84/24	102/24

HABITAT: Nests of *Formica fusca* Linn., Leeds, England (Hull Collection); recorded from several *Formica* species in Britain and Europe.

Hypoaspis astronomica (Koch)

Iphis astronomicus Koch, 1839, *Deutschl. C.M.A.* fasc. 27, t. 18.

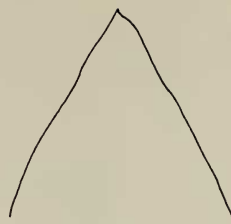
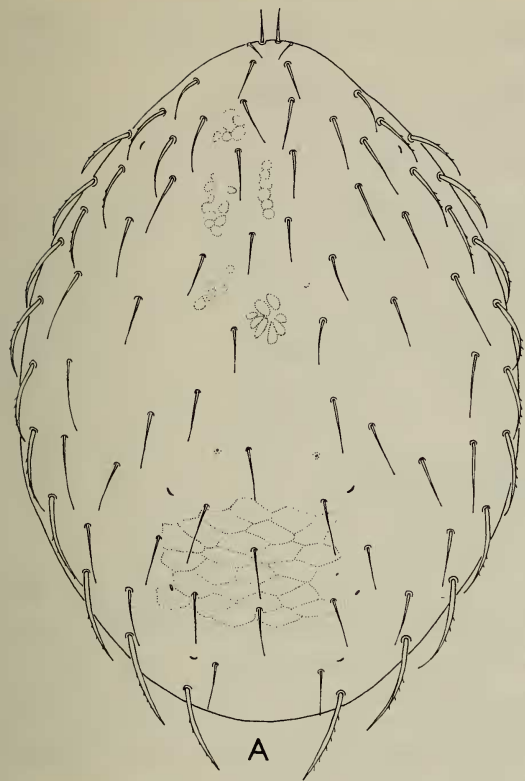
Laelaspis ovatus Willmann, 1951, *S.B. Akad. Wiss. Wien.* 160: 115, fig. 7 (**syn. nov.**).

Female: Chelicera with segment I, 45 μ ; II, 150 μ ; movable digit 36 μ , bidentate; fixed digit with about five teeth, pilus dentilis minute, setiform (Text-fig. 39c). Four pairs of gnathosomal setae with *c.s.* about 45 μ apart; *hyp*.2 about 36 μ apart. Deutosternum with six transverse rows of denticles; corniculi 30 μ long; hypostome with about six pairs of finger-like processes (Text-fig. 39d). Tectum capituli with anterior margin apparently smooth (Text-fig. 39b). Salivary styli slender, reaching tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele.

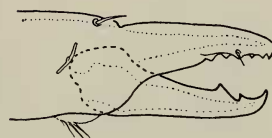
Dorsal shield (552 $\mu \times$ 396 μ) with 39 pairs of setae and three unpaired accessory setae (Text-fig. 39a). Setae of the *s* and *S* series and seta *Z*₅ relatively long, stout and barbed. Surface of shield reticulate.

Tritosternum with base 20 μ , laciniae 72 μ . Sternal shield (96 $\mu \times$ 96 μ) with heavily sclerotized margins; with three pairs of setae and two pairs of pores; metasternal setae on small shields, associated pores on cuticle. Between *st*₁, 63 μ ; between *st*₁ and *st*₃, 84 μ . Genito-ventral shield (186 $\mu \times$ 186 μ) greatly expanded behind coxae IV, with three pairs of setae. Anal shield (78 $\mu \times$ 102 μ) with maximum width at anterior margin 126 μ ; paranal setae 21 μ , postanal seta 33 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 39E. Peritreme ex-

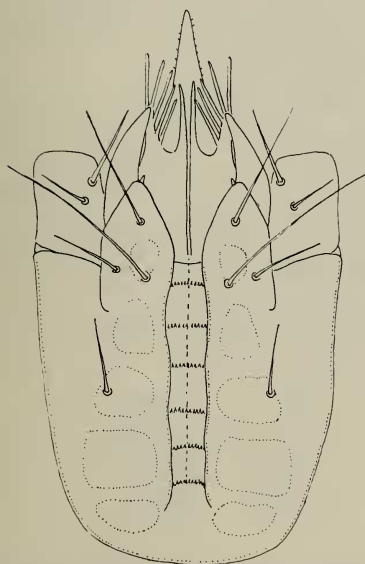
FIG. 39. *Hypoaspis astronomica* (Koch), female; dorsum of idiosoma (A); tectum (B); chelicera (C); venter of gnathosoma (D); venter of idiosoma (E).



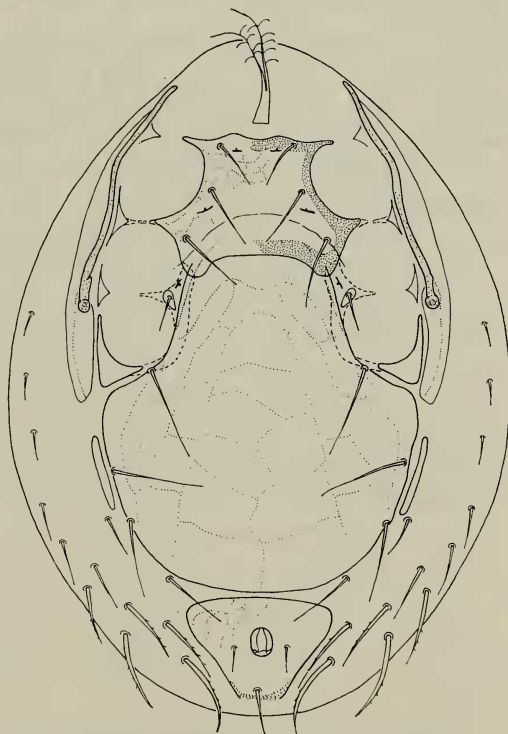
B



C



D



E

tends to anterior margin of coxa I; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Chaetotaxy of legs normal. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	70/27	48/33	42/33	60/30
tibia	75/24	48/33	40/27	60/27
tarsus	126/20	93/27	93/24	130/24

HABITAT: Ants' nests in Britain (Cornwall) and in Germany.

Hypoaspis equitans (Michael)

Laelaps equitans Michael, 1891. *Proc. zool. Soc. Lond.*: 649.

Female: Chelicera with segment I, 42 μ ; II, 126 μ ; movable digit 42 μ ; both digits virtually edentate with two slight irregularities on the internal margin; pilus dentilis short, setiform (Text-fig. 40B). Four pairs of gnathosomal setae with *c.s.* about 50 μ apart, *hyp.2* about 40 μ apart. Deutosternum with six transverse rows of denticles; corniculi 27 μ long; internal malae with inner and outer finger-like processes and shorter fimbriae between these. Salivary styli and tectum capituli not clearly visible. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (672 $\mu \times$ 486 μ) with 39 pairs of setae and six unpaired accessory setae distributed as in Text-fig. 40A. Most of the setae, especially in the opisthonotal region, are long and sinuous. Surface of shield reticulate.

Tritosternum with base 30 μ , lacininae 66 μ . Sternal shield (135 $\mu \times$ 144 μ) with three pairs of setae and two pairs of pores; metasternal setae free with associated pores. Between *st1*, 78 μ ; between *st1* and *st3*, 108 μ . Genito-ventral shield (210 $\mu \times$ 222 μ) expanded behind coxae IV, with two pairs of setae. Anal shield (126 $\mu \times$ 105 μ) with maximum width 150 μ at anterior margin; paranal setae 36 μ , postanal seta 85 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 40C. Peritreme extends beyond posterior margin of coxa I.

Legs with normal chaetotaxy. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	102/40	78/48	72/45	90/40
tibia	120/36	72/42	72/42	93/36
tarsus	198/33	132/30	144/30	180/30

HABITAT: Ants' nests [*Tetramorium caespitum* (Linn.)] in Britain (Cornwall, Lundy Island Berkshire).

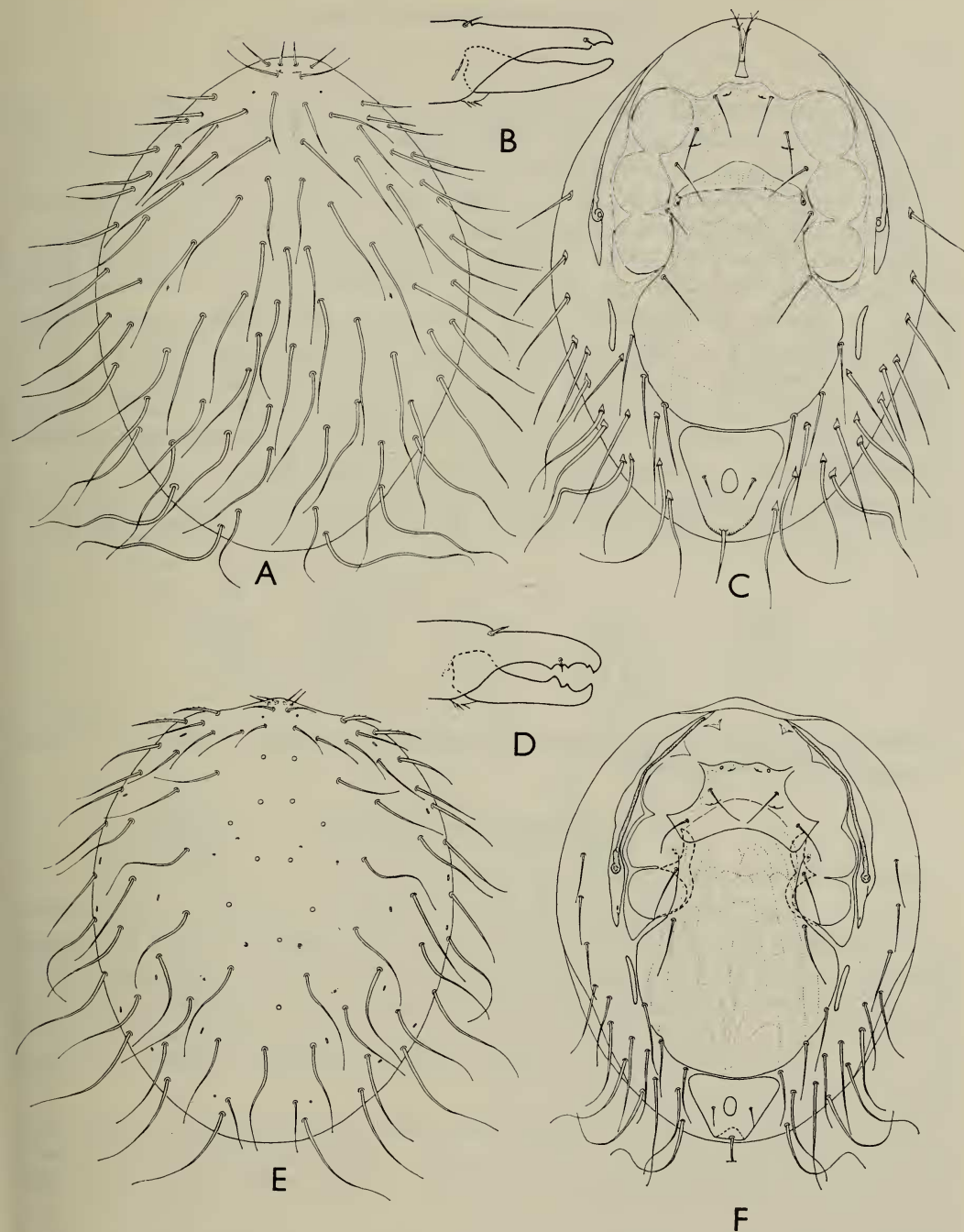


FIG. 40. A-C. *Hypoaspis equitans* (Michael), female; dorsum of idiosoma (A); chelicera (B); venter of idiosoma (C). D-F. *Hypoaspis humerata* (Berlese), female; chelicera (D); dorsum of idiosoma (E); venter of idiosoma (F).

Hypoaspis humerata (Berlese)

Laelaps (Laelaspis) humeratus Berlese, 1904, *Redia* 1: 425, pl. 18, figs. 151-153.

Female: Chelicera with segment II, 110 μ ; movable digit 36 μ , bidentate; fixed digit tridentate (Text-fig. 40D). No other details of the gnathosomal structure can be described owing to the poor condition of the only available specimen.

Dorsal shield (approximately 600 $\mu \times$ 490 μ) with 39 pairs of setae distributed as in Text-fig. 40E, and three unpaired accessory setae. Surface of shield reticulate.

Sternal shield (90 $\mu \times$ 120 μ) with three pairs of setae and two pairs of pores; metasternal setae free with associated pores. Between *st*1, 63 μ ; between *st*1 and *st*3, 84 μ . Genito-ventral shield (210 $\mu \times$ 198 μ) expanded behind coxae IV with maximum width 282 μ ; with two pairs of setae, a third pair being just on or off the margin of the shield. Anal shield (84 $\mu \times$ 90 μ) with maximum width 123 μ at anterior margin; paranal setae 30 μ long, postanal seta broken. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 40F. Peritreme extends approximately to middle of coxa I; posterior part of peritrematal shield free.

Legs apparently with normal chaetotaxy, although this cannot be checked on every segment. Legs rather short and stumpy. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	45/27	40/54	33/45	45/42
tibia	48/24	36/42	33/42	45/36
tarsus	100/24	75/30	75/33	102/30

HABITAT: Found in ants' nests [*Tetramorium caespitum* (Linn.)] in Britain (Cornwall) and in Luxemburg.

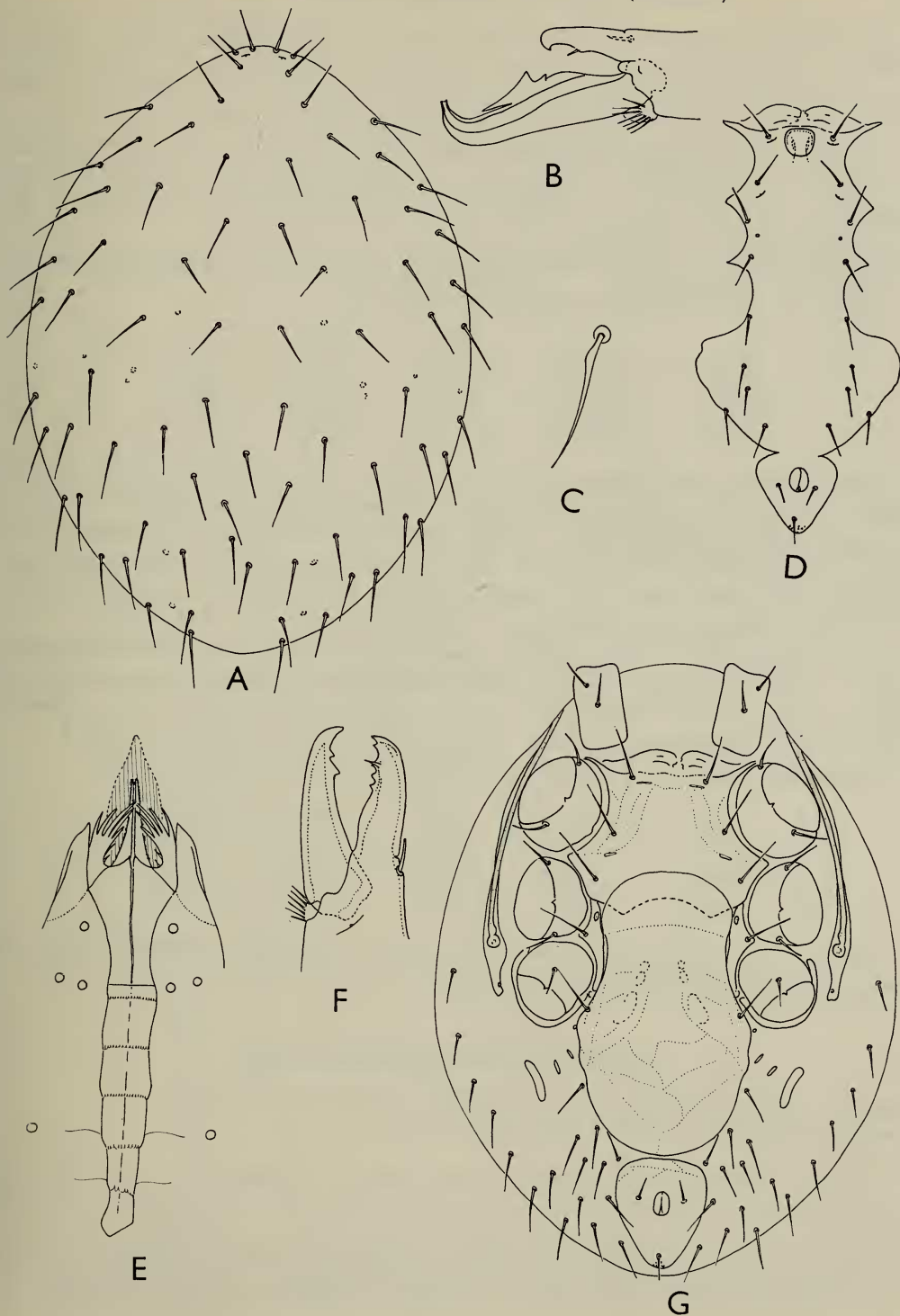
Hypoaspis acuta (Michael)

Laelaps acuta Michael, 1891, *Proc. zool. Soc. Lond.*: 652.

Female: Chelicera with segment I, 60 μ ; II, 177 μ ; movable digit 57 μ , bidentate; fixed digit with four teeth; pilus dentilis short, setiform; dorsal seta present (Text-fig. 41F). Four pairs of gnathosomal setae with c.s. about 66 μ apart; *hyp*.2 about 48 μ apart. Deutosternum with five transverse rows of denticles, each row multidenticulate; corniculi horn-like, 40 μ long; internal malae fimbriate (Text-fig. 41E). Tectum capituli with anterior margin apparently smooth. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (720 $\mu \times$ 468 μ) with 37 pairs of setae distributed as in Text-fig. 41A; setae *z*3 and *r*1 lacking on the podonotal region; about four accessory setae present on the opisthonotal region between the *J* series. Setae inflated sub-basally (Text-fig. 41C).

FIG. 41. *Hypoaspis acuta* (Michael). A. Dorsum of idiosoma of female; B. chelicera of male; C. dorsal seta *z*5 of female; D. holovenral shield of male; E. deutosternum and hypostome of female; F. chelicera of female; G. venter of idiosoma of female.



Tritosternum with base $48\ \mu$, laciniae $90\ \mu$. Sternal shield ($140\ \mu \times 150\ \mu$) granular, reticulated laterally, bearing three pairs of setae and two pairs of pores. Metasternal setae and pores situated on cuticle overlying the endopodal shields. Between *st*1, $80\ \mu$; between *st*1 and *st*3, $129\ \mu$. Genital shield ($168\ \mu \times 170\ \mu$) flask-shaped with genital setae only. Anal shield ($105\ \mu \times 100\ \mu$) pear-shaped, paranal setae $36\ \mu$, postanal seta $48\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 41G. Peritremes extend to anterior third of coxae I; peritrematal shields free posteriorly.

Chaetotaxy of legs normal except genu IV which has two postero-lateral setae ($2-\frac{2}{1}, \frac{3}{0}-2$). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	108/36	75/48	70/40	114/40
tibia	120/30	78/40	72/36	117/36
tarsus	192/30	140/33	147/32	228/33

Male: Chelicera with segment I, $48\ \mu$; II, $123\ \mu$; movable digit dentate, partially fused with a grooved spermadactyl which measures $60\ \mu$ in length from the base of the movable digit (Text-fig. 41B). Pilus dentilis and dorsal seta as in female. Four pairs of gnathosomal setae with *c.s.* about $54\ \mu$ apart; *hyp*.2 about $45\ \mu$ apart. Deutosternum with about four transverse rows of denticles; corniculi horn-like, $32\ \mu$ long; internal malae fimbriate. Pedipalps and tectum as in female.

Dorsal shield ($582\ \mu \times 354\ \mu$) with chaetotaxy as in female. Holoventral shield ($450\ \mu \times 108\ \mu$) expanded behind coxae IV, bearing nine pairs of setae excluding the anals (Text-fig. 41D). Between *st*1, $72\ \mu$; between *st*1 and *st*3, $100\ \mu$. Paranal setae $36\ \mu$, postanal seta $30\ \mu$ long. Peritremes extend to middle of coxae I.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	87/33	66/40	57/33	93/33
tibia	102/28	63/36	57/30	99/33
tarsus	162/27	114/30	120/24	186/27

HABITAT: In the nests of *Myrmica scabrinodis* Nylander in Mayo, Ireland, and *Camponotus herculeanus* (Linn.) in Europe.

Hypoaspis myrmecophila (Berlese)

Laelaps myrmecophilus Berlese, 1892, *Acari, Myr. Scorp. Ital.* fasc. 69, no. 2.

Laelaps ovalis (Moniez), Berlese, 1904, *Redia* 1: 409.

Female: Chelicera with segment I, $150-190\ \mu$; II, $324-336\ \mu$; movable digit $135\ \mu$, bidentate; fixed digit with about nine teeth, pilus dentilis short, setiform (Text-fig. 42E). Four pairs of gnathosomal setae with *c.s.* about $84\ \mu$ apart, *hyp*.2 about $70\ \mu$ apart. Deutosternum with six transverse rows of denticles; corniculi $98\ \mu$; internal malae with slender inner and triangular median, pilose lobes, and

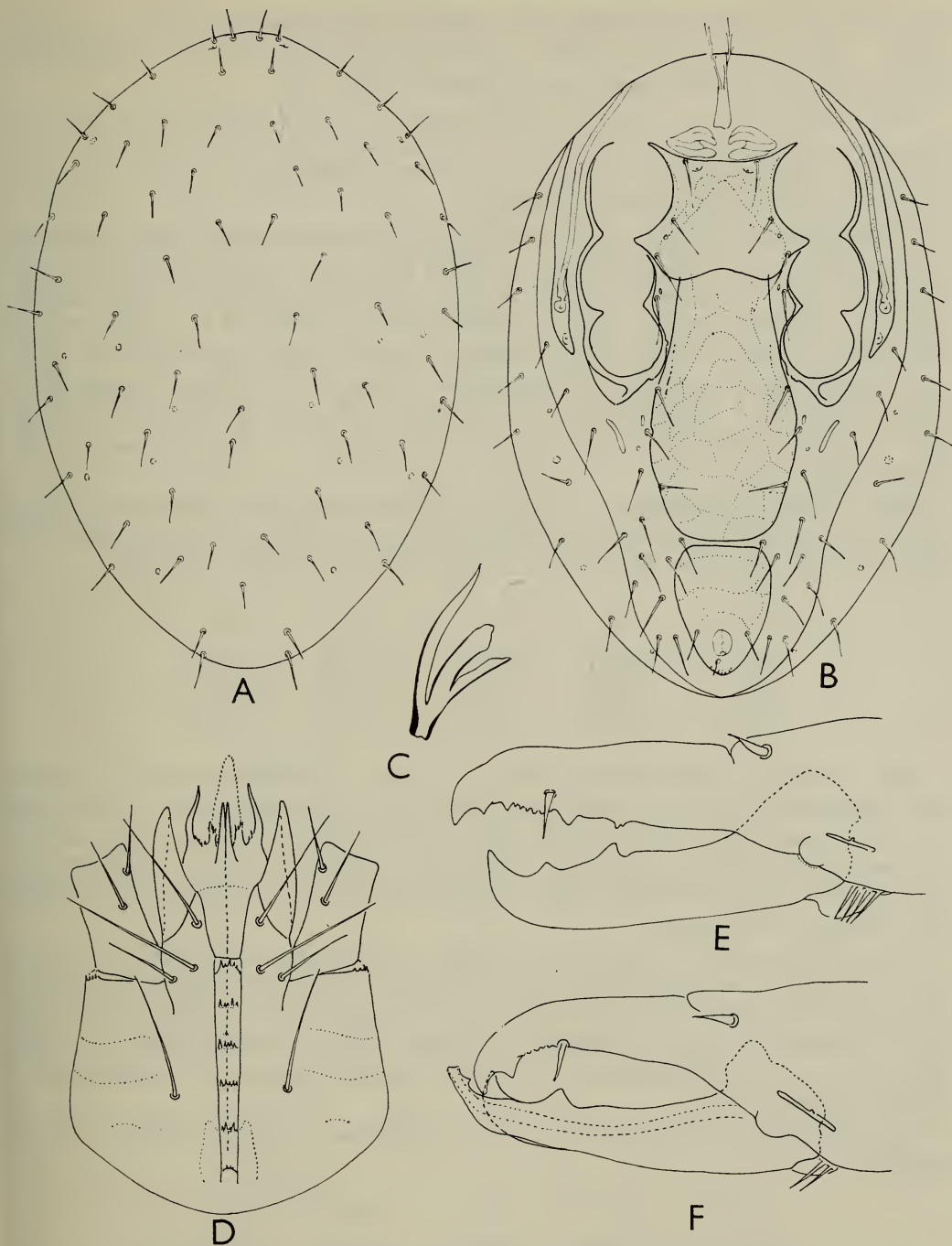


FIG. 42. *Hypoaspis myrmecophila* (Berlese). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. apotele of pedipalp; D. venter of gnathosoma of female; E. chelicera of female; F. chelicera of male.

long, slender, outer lobes (Text-fig. 42D). Tectum capituli with denticulate anterior margin. Salivary styli long, slender, reaching approximately to tips of corniculi. Pedipalp (2-5-6-14) with three-tined apotele (Text-fig. 42C).

Dorsal shield (1,116 μ $\times$ 768 μ) with 41 pairs of slender, simple setae and five unpaired accessory setae (Text-fig. 42A); an extra pair of *r* setae is present in the podonotal region and setae *pxi* are present in the opisthonotal region. Surface of shield granular, with sculpturing anteriorly.

Tritosternum with base 60 μ , lacinae 168 μ ; pre-endopodal shields large, reticulate and granular. Sternal shield (180 μ $\times$ 240 μ) granular, reticulate antero-laterally, with three pairs of setae and two pairs of pores; metasternal setae free with associated pores. Between *st1*, 126-132 μ ; between *st1* and *st3*, 180-192 μ . Genito-ventral shield (290 μ $\times$ 246 μ) with one pair of genital and one pair of opisthogastric setae. Anal shield (198 μ $\times$ 120 μ) with maximum width 186 μ ; paranal setae 48 μ ; postanal seta 30 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 42B. Peritreme extends to about posterior third of coxa I; posterior part of peritrematal shield free.

Legs with normal chaetotaxy. Relatively stout setae present on femur I (*pd*₂₋₃), tarsus II (ventrals, *al*₁, *pl*₁, *md*), and femur IV (*ad*₂ and *pd*₁). Seta *pl* on genu IV stout and spine-like (Text-fig. 44B). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	192/66	156/90	126/66	180/78
tibia	222/60	144/80	120/66	180/78
tarsus	300/54	228/63	228/54	306/63

Male: Chelicera with segment I, 108 μ ; II, 300 μ ; movable digit 126 μ , unidentate; spermadactyl 140 μ , a small tooth near its tip; fixed digit with one large and about five small teeth; pilus dentilis short, setiform (Text-fig. 42F). Four pairs of gnathosomal setae with *c.s.* about 78 μ apart, *hyp.2* about 75 μ apart. Corniculi 90 μ long, internal malae not clearly visible. Deutosternum, salivary styli, tectum capituli and pedipalps as in female.

Dorsal shield (1,080 μ $\times$ 756 μ) as in female. Holovenal shield (816 μ $\times$ 216 μ) with four pairs of setae and three pairs of pores in the sternal region, one pair of genital and five pairs of opisthogastric setae in the genito-ventral region (Text-fig. 44A). Between *st1*, 114 μ ; between *st1* and *st3*, 195 μ . Paranal setae 60 μ , postanal seta 42 μ . Peritreme extends to posterior margin of coxa I. Posterior part of peritrematal shield free.

Legs with normal chaetotaxy, stout setae as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	180/66	162/90	132/72	192/84
tibia	210/60	150/84	126/66	198/78
tarsus	270/54	220/60	240/54	300/60

HABITAT : Found in ants' nests in Britain (Cornwall, Devon, Wales, Isle of Wight) and Europe.

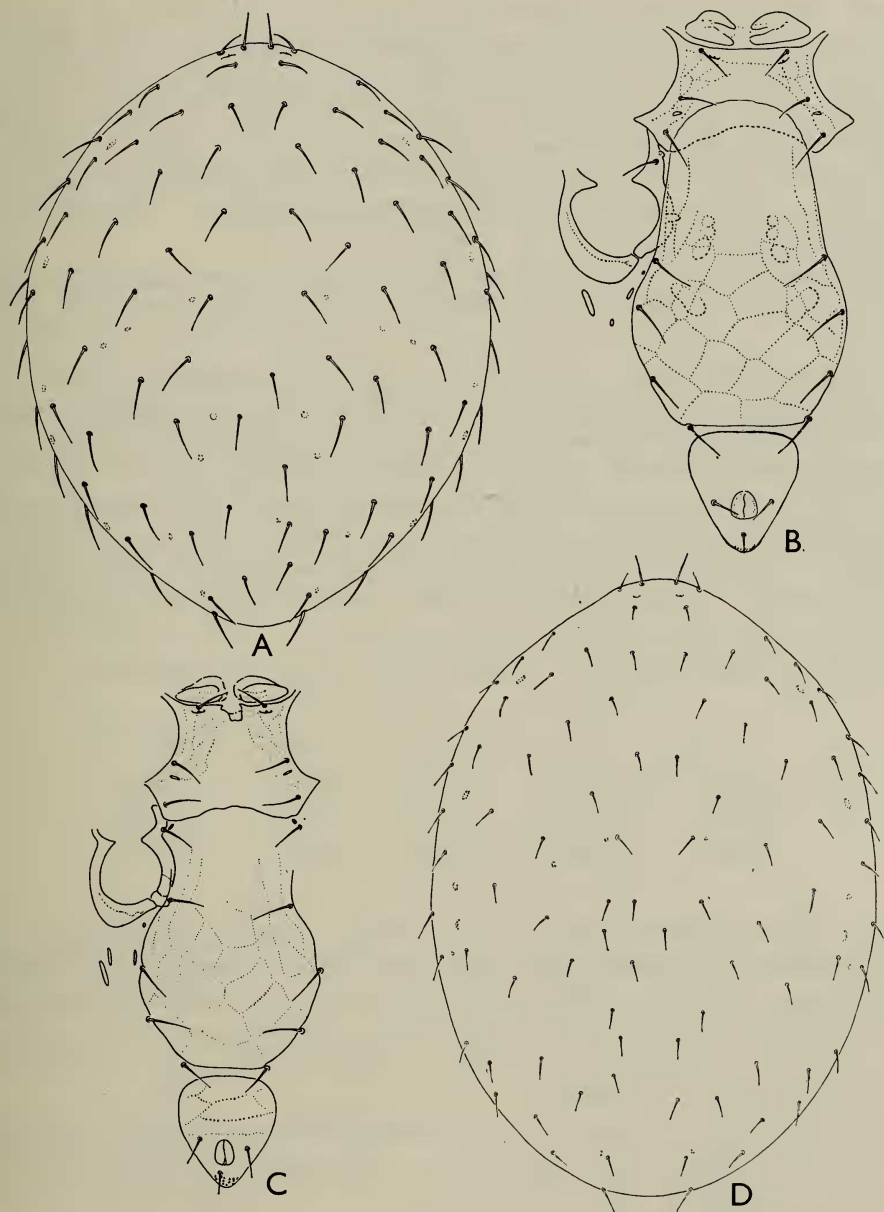


FIG. 43. A-B. *Hypoaspis myrmophila* (Michael), female ; dorsum (A) and venter (B) of idiosoma. C-D. *Hypoaspis laevis* (Michael), female ; venter (c) and dorsum (D) of idiosoma.

Hypoaspis myrmophila (Michael)

Laelaps myrmophila Michael, 1891, *Proc. zool. Soc. Lond.* : 649.

Female : Chelicera with segment I, 90 μ ; II, 246 μ ; movable digit 105 μ , bidentate ; fixed digit with four conspicuous teeth and a row of 3-5 tiny teeth ; pilus dentilis and dorsal seta normal. Four pairs of gnathosomal setae with c.s. about 66 μ apart, *hyp.2* about 63 μ apart. Deutosternum with six transverse rows of denticles, each row multidenticulate ; corniculi horn-like, 63 μ long ; internal malae as in *H. myrmecophila*, but middle process almost as long as inner, and outer process forked at tip. Tectum capituli with anterior margin serrated. Pedipalp (2-5-6-14) with three-tined apotele.

Dorsal shield (696 $\mu \times$ 528 μ) with 40 pairs of setae and seven unpaired accessories distributed as in Text-fig. 43A ; an extra pair of *r* setae is present in the podonotal region.

Tritosternum with base 40 μ , laciniae 114 μ . Pre-endopodal shields present. Sternal shield (96 $\mu \times$ 180 μ) reticulated antero-laterally, with three pairs of setae and two pairs of pores ; metasternal setae and associated pores situated over the endopodal shields. Between *st1*, 99 μ ; between *st1* and *st3*, 105 μ . Genito-ventral shield (210 $\mu \times$ 190 μ) reticulated, bearing a pair of genital and two pairs of opisthogastric setae. Anal shield (114 $\mu \times$ 99 μ ; maximum width 138 μ) with the usual three setae. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 43B. Peritreme extends to about middle of coxa I ; posterior part of peritrematal shield free.

Legs with normal chaetotaxy. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	105/48	96/60	66/42	114/48
tibia	126/45	90/57	69/42	114/48
tarsus	198/42	150/42	140/36	180/38

Male : Chelicera with segment I, 78 μ ; II, 210 μ ; movable digit 84 μ , unidentate ; spermadactyl relatively short, 102 μ from base of movable digit ; fixed digit with one large and two small teeth (Text-fig. 44D). Pilus dentilis and dorsal seta normal. Four pairs of gnathosomal setae with c.s. about 60 μ apart, *hyp.2* about 57 μ apart. Corniculi horn-like, 54 μ long ; internal malae pilose. Deutosternum, tectum and pedipalps as in female.

Dorsal shield (612 $\mu \times$ 420 μ) with chaetotaxy as in female. Pre-endopodal shields present. Holovenral shield (516 $\mu \times$ 144 μ) with ten pairs of setae, excluding the anals (Text-fig. 44E). Between *st1*, 87 μ ; between *st1* and *st3*, 117 μ . Peritreme extends to about middle of coxa I.

Legs with normal chaetotaxy. Genu and tibia II with seta *pv* stout ; tarsus II with ventral setae and *al*₁ and *pl*₁ stout. Length/width (in μ) of leg segments :

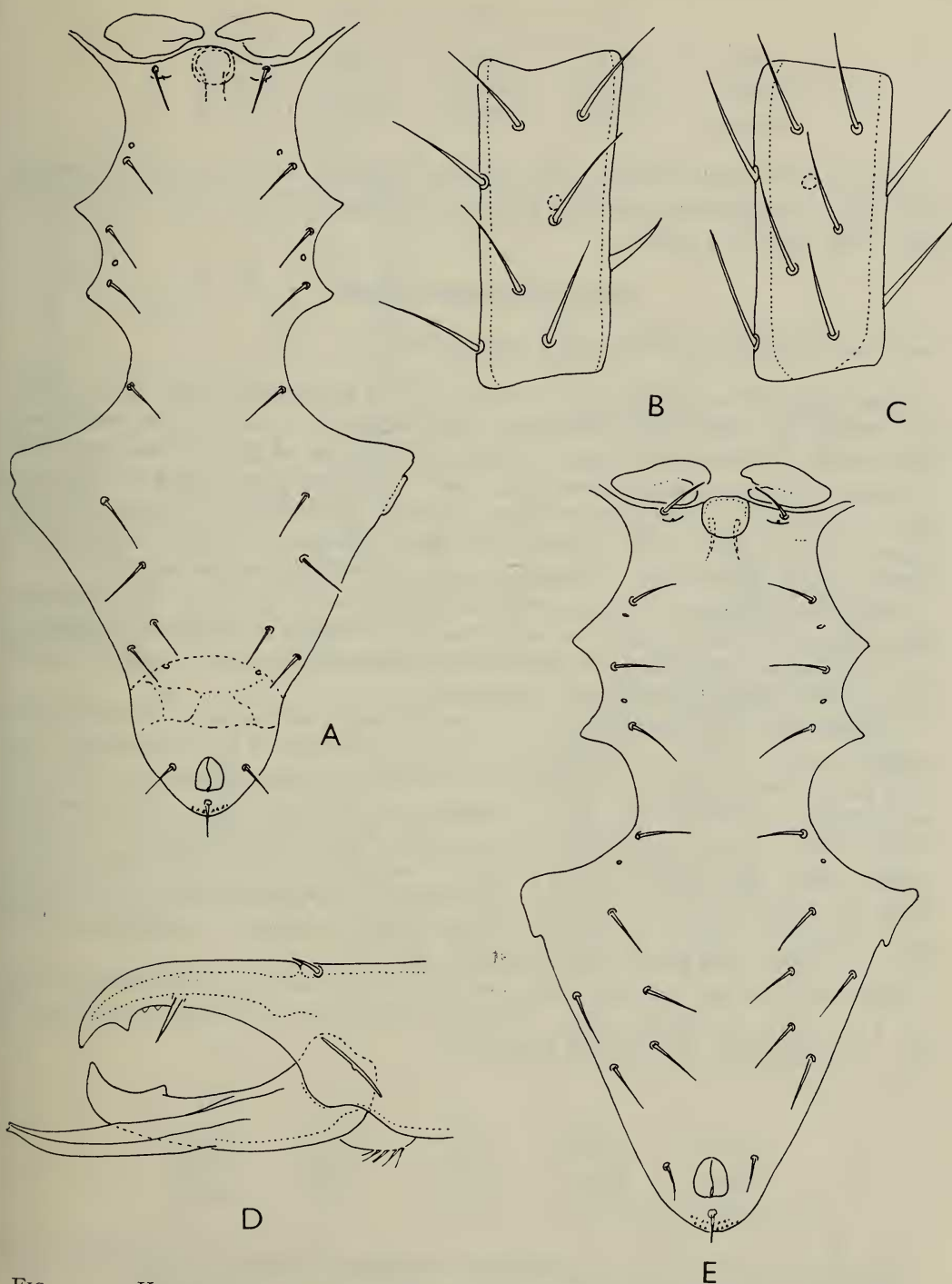


FIG. 44. A. *Hypoaspis myrmecophila* (Berlese), holoventral shield of male; B. *H. myrmecophila*, genu IV of female; C. *Hypoaspis laevis* (Michael), genu IV of female; D. *Hypoaspis myrmecophila* (Michael), chelicera of male; E. *H. myrmecophila*, holoventral shield of male.

	I	II	III	IV
genu	96/45	90/57	66/38	99/45
tibia	111/38	84/51	63/39	105/45
tarsus	180/36	138/38	126/32	162/36

HABITAT: The nests of ants [*Lasius mixtus* Nylander, *L. flavus* (Fabr.), *Formica fusca* Linn., *Tetramorium caespitum* (Linn.)] in Cornwall, Surrey and Northumberland; ants' nests in Corsica.

Hypoaspis laevis (Michael)

Laelaps laevis Michael, 1891, *Proc. zool. Soc. Lond.*: 648.

Female: Chelicera with segment I, 90 μ ; II, 324 μ ; movable digit 130 μ , bidentate; fixed digit with three prominent teeth and a row of about four small ones. Pilus dentilis and dorsal seta short, setiform. Four pairs of gnathosomal setae with c.s. about 102 μ apart, *hyp.2* about 78 μ apart. Deutosternum with five transverse rows of denticles (4-9 denticles per row). Corniculi horn-like, 80 μ long; internal malae comprise pilose outer, middle and inner processes. Tectum capituli with anterior margin denticulate. Pedipalp (2-5-6-14) with three-tined apotele.

Dorsal shield (1,140 $\mu \times 770 \mu$) with 41 pairs of setae and about six accessories distributed as in Text-fig. 43D; an additional pair of *r* setae is present on the podonotal region and an extra pair of *px* setae on the opisthonotal region. Surface of shield granular with some striations near the margin.

Tritosternum with laciniae about $2\frac{1}{2}$ times the length of the base. Pre-endopodal shields present. Sternal shield (204 $\mu \times 246 \mu$) reticulated antero-laterally, with three pairs of setae and two pairs of pores; metasternal setae situated over the endopodal shields. Between *st1*, 70 μ ; between *st1* and *st3*, 192 μ . Genito-ventral shield (312 $\mu \times 237 \mu$) reticulated, with one pair of genital and two pairs of opisthogastric setae. Anal shield (186 $\mu \times 132 \mu$; maximum width 195 μ) with paranal setae 45 μ , postanal seta 21 μ long. Sclerotization of opisthogaster as in Text-fig. 43C. Peritreme extends at least to anterior margin of coxa I; peritrematal shield fused anteriorly with dorsal shield, posterior part free.

Chaetotaxy of legs normal except genu IV which has two postero-lateral setae ($2-\frac{2}{1}$, $\frac{3}{0}-2$) as in Text-fig. 44C. Tarsus II with several stout setae (*av*₁, *pv*₁, *al*₁, *pl*₁). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	180/66	144/87	126/66	180/75
tibia	222/57	150/80	126/60	198/75
tarsus	306/54	228/57	240/48	318/57

HABITAT: Nests of ants [*Tetramorium caespitum* (Linn.)] in Cornwall and in Austria.

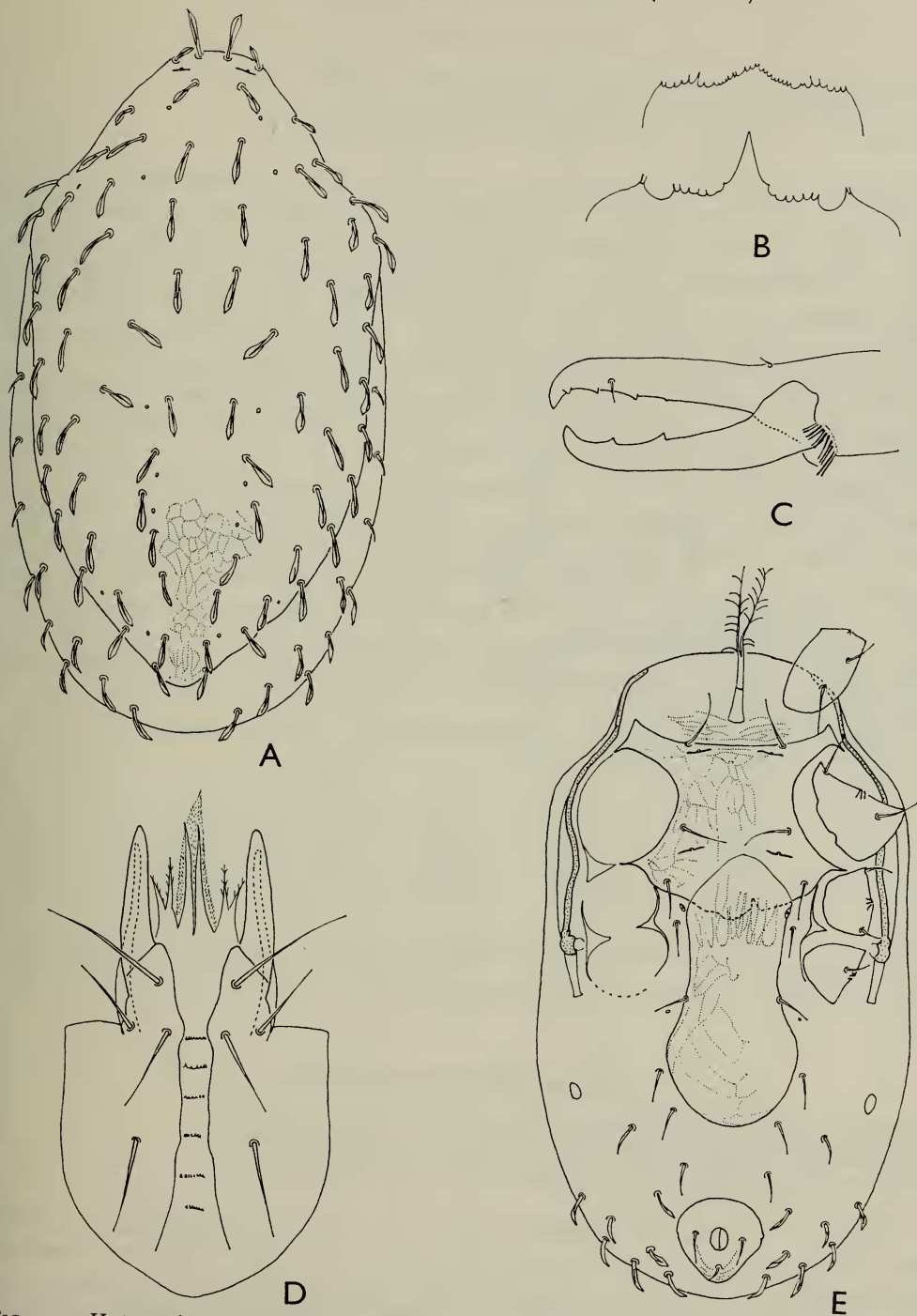


FIG. 45. *Hypoaspis miles* (Berlese), female; dorsum of idiosoma (A); tecta capituli (B); chelicera (C); venter of gnathosoma (D); venter of idiosoma (E).

Hypoaspis miles (Berlese)

Laelaps (Iphis) miles Berlese, 1892, *Acari, Myr. Scorp. Ital. fasc.* 63, no. 9.

Cosmolaelaps gurabensis Fox, 1946, *J. Parasit.* **32**: 449, fig. 1.

Bregetova, 1956, *Opred. Faune SSSR.* **61**: 75, figs. (**syn. nov.**).

Female: Chelicera with segment I, 96 μ ; II, 216 μ ; movable digit 130 μ long, bidentate; fixed digit with about four teeth; pilus dentilis short, setiform (Text-fig. 45c). Four pairs of gnathosomal setae with c.s. about 63 μ and *hyp.2* about 66 μ apart. Deutosternum with six transverse rows of denticles; corniculi 90 μ long; outer processes of internal malae fringed (Text-fig. 45d). Tectum capituli with denticulate anterior margin (Text-fig. 45b). Salivary styli conspicuous, almost reaching tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (648 $\mu \times$ 348 μ) with 37 pairs of leaf-like setae distributed as in Text-fig. 45A; setae *px2* and *px3* absent. Surface of shield reticulated; no hypertrichy; seven pairs of *R* setae on the cuticle.

Tritosternum with base 60 μ , laciniae 96 μ . Sternal shield (180 $\mu \times$ 138 μ) extending almost to posterior margin of coxa III, with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st1*, 96 μ ; between *st1* and *st3*, 144 μ . Genital shield flask-shaped (135 $\mu \times$ 102 μ), with one pair of setae. Anal shield (72 $\mu \times$ 87 μ) with paranal setae about 24 μ , postanal seta about 15 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 45E. Peritreme extends nearly to anterior margin of coxa I; peritrematal shields free anteriorly and posteriorly.

Legs with normal chaetotaxy. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	87/30	84/50	60/33	93/36
tibia	93/24	78/48	60/33	96/36
tarsus	170/27	144/36	135/30	186/30

HABITAT: Found in decaying oat spillage at Leith, Scotland. Recorded in the literature from a variety of rodents and their nests in Europe, the U.S.S.R. and the U.S.A.

Hypoaspis oblonga (Halbert)

Laelaps (Hypoaspis) oblongus Halbert, 1915, *Proc. R. Irish Acad.* **31**: 70.

Pseudoparasitus angulatus Berlese, 1917, *Redia* **12**: 164 (**syn. nov.**).

Pseudoparasitus (Alloparasitus) angulatus Berlese, 1921, *Redia* **14**: 169.

Female: Chelicera with segment I, 60 μ ; II, 162 μ ; movable digit 68 μ , bidentate; fixed digit with about six teeth (Text-fig. 46b); pilus dentilis and dorsal seta short, setiform. Four pairs of gnathosomal setae with c.s. about 42 μ apart, *hyp.2* about 46 μ apart. Deutosternum with six transverse rows of denticles (4-6 denticles per row). Corniculi horn-like, 42 μ long; internal malae fimbriate (Text-fig. 46e).

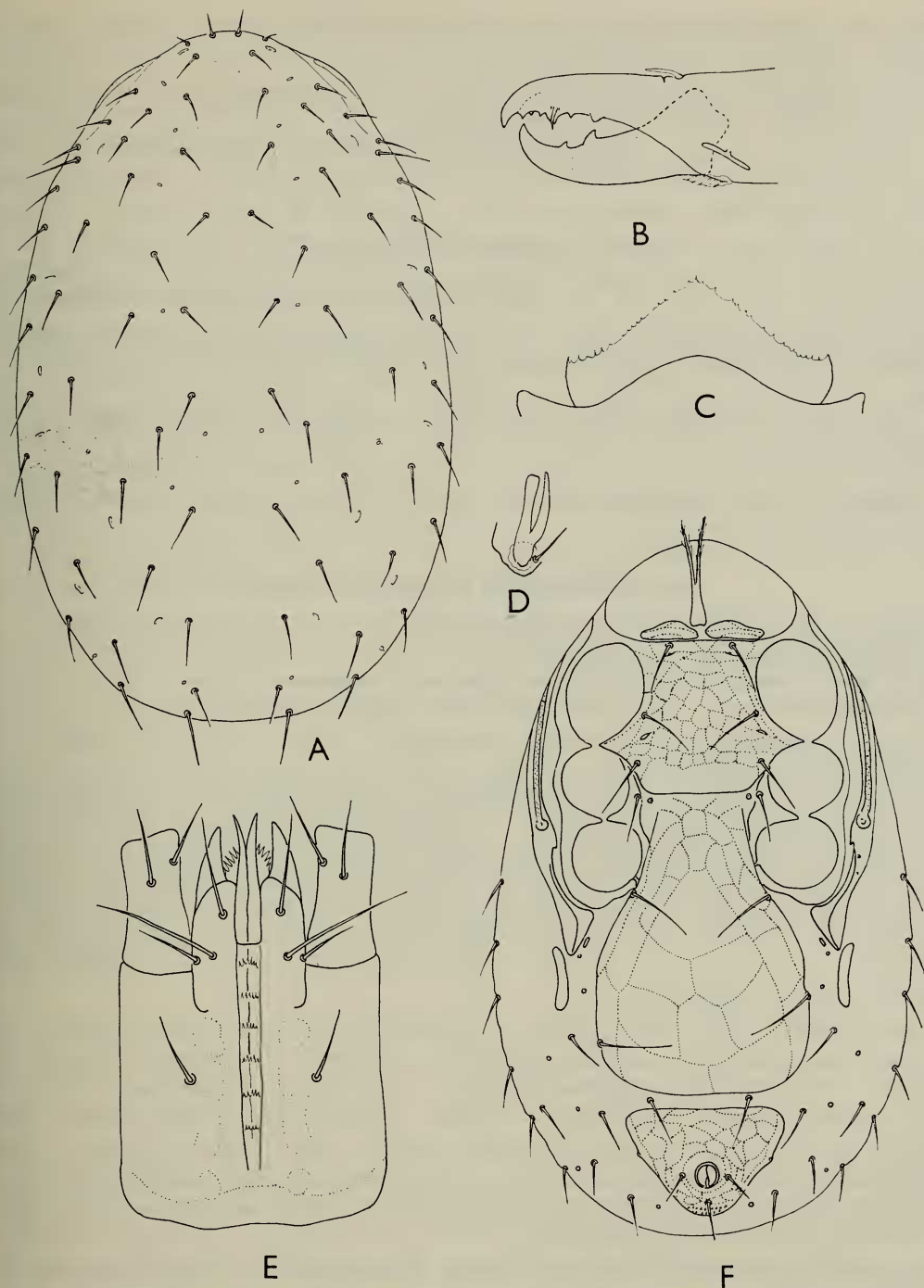


FIG. 46. *Hypoaspis oblonga* (Halbert), female; dorsum of idiosoma (A); chelicera (B); tectum capituli (C); apotele of pedipalp (D); venter of gnathosoma (E); venter of idiosoma (F).

Tectum capituli with anterior margin denticulate (Text-fig. 46c). Pedipalp (2-5-6-14) with two-tined apotele (Text-fig. 46d).

Dorsal shield ($684\ \mu \times 408\ \mu$) with 39 pairs of setae distributed as in Text-fig. 46A; no hypertrichy. Surface of shield reticulated.

Tritosternum bipartite; pre-endopodal shields present. Sternal shield ($150\ \mu \times 132\ \mu$) reticulated, with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st*1, $70\ \mu$; between *st*1 and *st*3, $120\ \mu$. Genito-ventral shield ($204\ \mu \times 144\ \mu$) expanded behind coxae IV and bearing a pair of genital and a pair of opisthogastric setae. Anal shield ($100\ \mu \times 100\ \mu$; maximum width $156\ \mu$); paranal setae $36\ \mu$ long, postanal seta slightly longer. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 46f. Peritreme extends to middle of coxa I; peritrematal shields extend posteriorly well beyond level of coxae IV, free.

Legs with normal chaetotaxy, except genu IV which has only one antero-lateral seta ($1-\frac{2}{1}, \frac{3}{0}-1$).

HABITAT: Under bark of decayed trees and in moss, in Ireland, Scotland, England (Northumberland) and Europe.

Genus *PSEUDOPARASITUS* Oudemans

Pseudoparasitus Oudemans, 1902, *Tijdschr. Ent.* **45**: 29.

Hoplolaelaps Berlese, 1903, *Zool. Anz.* **27**: 14.

Laelapsoides Willmann, 1952, *Veroff. Inst. Meersforsch. Bremerhaven* **1**: 150.

Austrogamasellus Domrow, 1957, *Proc. Linn. Soc. N.S.W.* **81**: 204, (**syn. nov.**).

Type: *Laelaps meridionalis* Canestrini, 1882.

This genus is closely related to *Ololaelaps* Berlese and differs chiefly in the presence of a discrete anal shield in the female. Chelicerae chelate-dentate in the adults with the movable digit bidentate in the female and unidentate in the male. Pilus dentilis and dorsal seta simple; fissures normal. Spermadactyl long, slender, groove directed anteriorly. Chaetotaxy of venter of gnathosoma and pedipalps normal. Apotele three-tined, posterior tine reduced. Deutosternum with six transverse rows of denticles; internal malae strong; corniculi horn-like. Tectum capituli with anterior margin denticulate.

Dorsal shield entire with 39 pairs of setae (posterior accessories present); no unpaired accessory setae in the region of the *J* series. Tritosternum normal, bipartite. Pre-endopodal shields conspicuous. Sternal shield in the female with three pairs of setae and two pairs of pores. Genito-ventral shield large with four or more pairs of setae of which two pairs are widely removed from its lateral margins. Anal shield free, paranals at level of anterior margin of anus. Podal shields posterior to coxae IV large, not fused with the peritrematal shield. Male with holovenral shield; peritrematal shields free posteriorly.

Leg chaetotaxy normal, seta *av*₁ on femur II spine-like in the female, spur-like in the male. Coxa II without distinct anterior spine. Ambulacra with paired claws.

We have not studied the immature stages of this genus.

The females of the two British representatives of *Pseudoparasitus* may be readily distinguished by the size and chaetotaxy of the genito-ventral shield, *P. centralis* having five pairs of setae on the shield and *P. dentatus* four pairs. *P. centralis* may be a synonym of *P. meridionalis*, but we are unable to reach a definite conclusion on this since the type material of *meridionalis* appears to be lost.

Pseudoparasitus centralis Berlese

Pseudoparasitus centralis Berlese, 1921, *Redia* **14**: 167.

Female: Chelicera with segment I, 66 μ ; II, 162 μ ; movable digit 66 μ , bidentate; fixed digit unidentate; pilus dentilis short, setiform (Text-fig. 47D). Four pairs of gnathosomal setae with *c.s.* about 45 μ apart; *hyp.2* about 42 μ apart. Deutosternum with six transverse rows of denticles (1–3 per row); corniculi 40 μ long; internal malae finger-like and denticulate (Text-fig. 47F). Tectum capituli with denticulate anterior margin. Salivary styli do not quite reach tips of corniculi. Pedipalp (2–5–6–14) with three-tined apotele.

Dorsal shield (588 $\mu \times$ 420 μ) with 39 pairs of setae distributed as in Text-fig. 47A. Surface of shield reticulate and granular; no hypertrichy.

Tritosternum with base 27 μ , laciniae about 78 μ . Sternal shield (126 $\mu \times$ 114 μ) extends to posterior margin of coxa III, with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st1*, 54 μ ; between *st1* and *st3*, 99 μ . Genital shield (180 $\mu \times$ 138 μ) flask-shaped, expanded behind coxae IV, with truncate posterior margin, bearing five pairs of setae. Between *gen.*, 120 μ ; between *Jv2*, 114 μ . Anal shield (96 $\mu \times$ 105 μ) with a straight anterior margin measuring 180 μ . Paranal setae 30 μ , postanal seta 10 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 47B. Peritreme extends to anterior part of coxa II; peritrematal shield fused anteriorly with dorsal shield, free posteriorly.

Legs with normal chaetotaxy. Setae *av*₁ on femur II and *pd*₁ on femur IV stout and spine-like. Ventral setae on tarsus II stout, pointed. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	75/33	69/45	45/33	63/32
tibia	81/27	57/42	42/35	66/32
tarsus	132/24	96/32	90/28	120/30

Male: Chelicera with segment I, 54 μ ; II, 132 μ ; movable digit 54 μ , unidentate; spermadactyl as in Text-fig. 47C; fixed digit bidentate, pilus dentilis slender, setiform. Four pairs of gnathosomal setae with distance between *c.s.* equal to that between *hyp.2* (42 μ). Deutosternum with six transverse rows of denticles (2–4 per row); corniculi 30 μ long. Internal malae elongate, triangular, pilose. Tectum and pedipalps as in female.

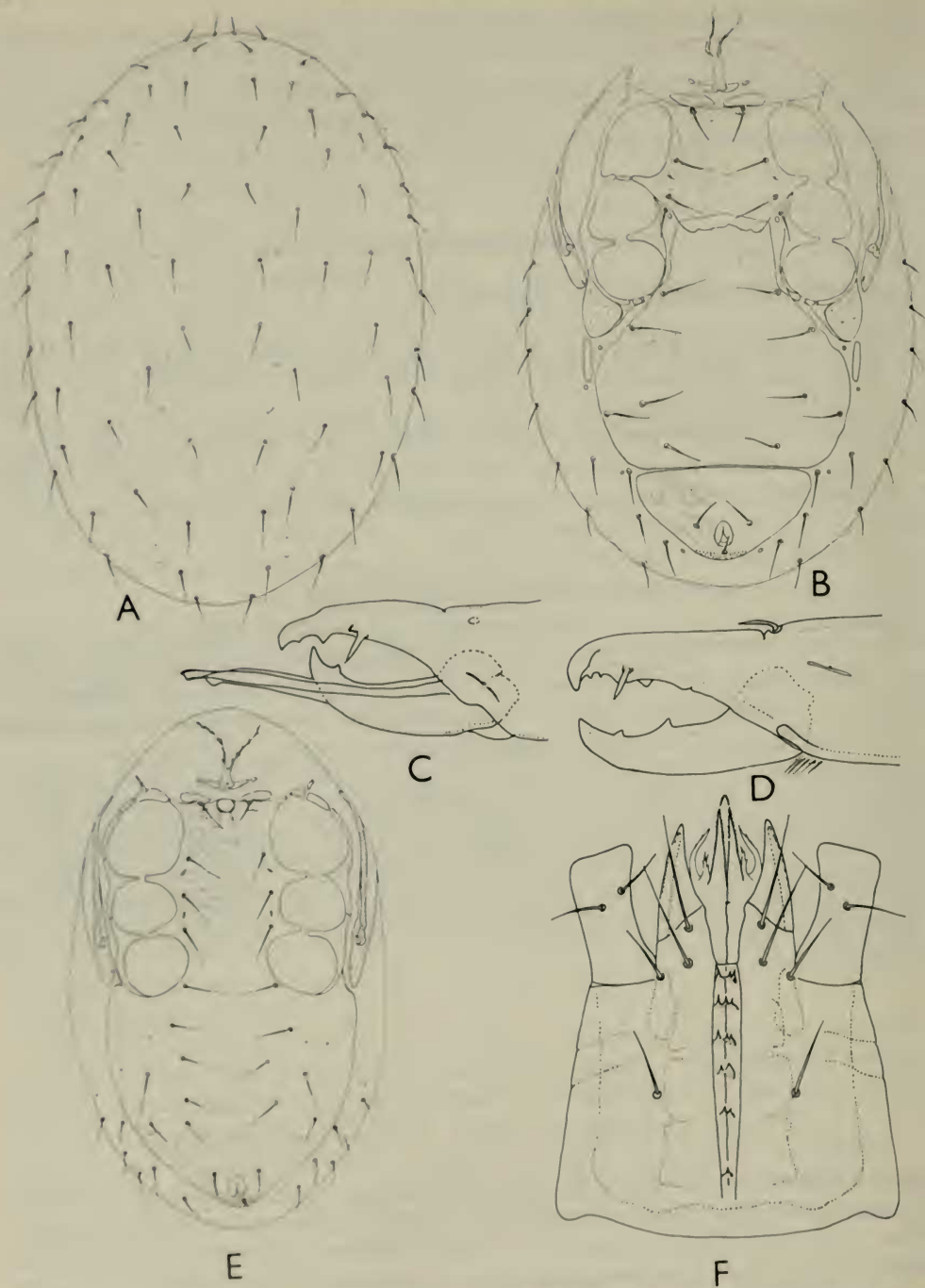


FIG. 47. *Pseudoparasitus centralis* (Berlese). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. chelicera of male; D. chelicera of female; E. venter of idiosoma of male; F. venter of gnathosoma of female.

Dorsal shield ($495\ \mu \times 300\ \mu$) with 39 pairs of setae distributed as in female. Tritosternum with base $21\ \mu$, laciniae $63\ \mu$. Holovenal shield ($390\ \mu \times 99\ \mu$) with four pairs of setae and three pairs of pores in the sternal region, six pairs of setae in the genito-ventral region. Between $st1$, $45\ \mu$; between $st1$ and $st3$, $90\ \mu$. Paranal setae $24\ \mu$, postanal seta $12\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 47E. Peritreme extends nearly to anterior margin of coxa II; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Chaetotaxy of legs normal. Femur I with setae ad_2 and pd_3 short, stout and spine-like; femur II with seta av_1 a stout spine; genu II with seta pv inflated basally; femur IV with seta pd_3 inflated. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	69/27	66/45	42/30	60/36
tibia	72/27	54/42	40/32	60/40
tarsus	120/22	84/30	84/24	114/30

HABITAT: Free-living in litter under deciduous trees etc. in Britain and Europe.

Pseudoparasitus dentatus (Halbert)

Laelaps dentatus Halbert, 1920, *Proc. R. Irish Acad.* **25**: 123.

Female: Chelicera with segment I, $54\ \mu$ II, $162\ \mu$; movable digit $70\ \mu$, bidentate; fixed digit with four teeth; pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about $48\ \mu$ apart, $hyp.2$ 42 – $45\ \mu$ apart. Deutosternum with six transverse rows of denticles (5–7 per row); corniculi 45 – $48\ \mu$ long. Internal malae as in *P. centralis*. Tectum capituli with denticulate anterior margin. Pedipalp (2–5–6–14) with three-tined apotele.

Dorsal shield (564 – $678\ \mu \times 348$ – $360\ \mu$) with 39 pairs of setae distributed as in Text-fig. 48A. Surface of shield reticulate; no hypertrichy.

Tritosternum with base $33\ \mu$, laciniae $81\ \mu$. Sternal shield (150 – $180\ \mu \times 114$ – $120\ \mu$) with convex posterior margin reaching nearly to posterior margin of coxa III; with three pairs of setae and two pairs of pores, the second pair small and circular; metasternal setae free with associated pores. Between $st1$, 66 – $72\ \mu$; between $st1$ and $st3$, 108 – $132\ \mu$. Genital shield (192 – $216\ \mu \times 105\ \mu$) flask-shaped with four pairs of setae; between $gen.$, $102\ \mu$; between $Jv2$, $84\ \mu$. Anal shield (60 – $68\ \mu \times 75$ – $90\ \mu$) with maximum width (123 – $170\ \mu$) at anterior margin; paranal setae 30 – $40\ \mu$, postanal seta 18 – $30\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 48B. Peritreme extends to about the anterior fourth of coxa II; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Legs with normal chaetotaxy. Femur II with seta av_1 stout. Femur IV with seta pd , stout, spine-like. Tarsus II has setae av_1 , av_2 , pv_1 , pv_2 , pl_1 and mv all stout basally with fine tips. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	80/30	75/40	45/30	72/36
tibia	87/30	60/42	45/30	72/33
tarsus	138/27	87/32	90/27	105/30

HABITAT : Free-living (in tidal debris, moss under *Calluna*, humus under deciduous trees) in Britain, Ireland and the Channel Islands.

Genus **OLOLAEAPS** Berlese

Hypoaspis Berlese, 1903, *Zool. Anz.* **27** : 14 (non *Hypoaspis* Canestrini).

Ololaelaps Berlese, 1904, *Redia* **1** : 260.

Pristolaelaps Womersley, 1956, *J. Linn. Soc. Lond. Zool.* **42** : 511.

Type : *Hypoaspis venetus* Berlese, 1903.

Medium to heavily sclerotized mites. Chelicerae chelate-dentate ; movable digit bidentate in the female, unidentate in the male ; spermadactyl groove straight or

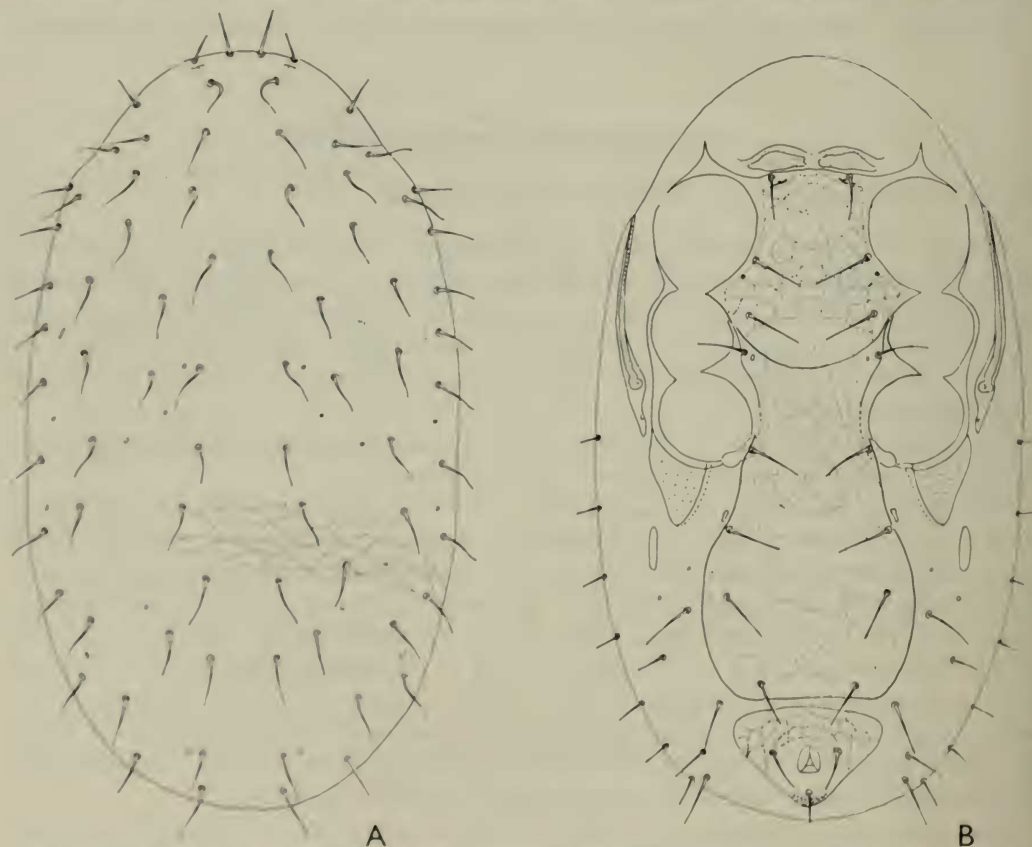


FIG. 48. *Pseudoparasitus dentatus* (Halbert), female ; dorsum (A) and venter (B) of idiosoma.

sinuous. Pilus dentilis and dorsal seta simple, fissures normal. Chaetotaxy of venter of gnathosoma and pedipalps normal; apotele three-tined, posterior tine reduced. Deutosternum with six transverse rows of denticles. Internal malae well-developed; corniculi horn-like. Tectum capituli with rounded, minutely denticulate anterior margin.

Dorsal surface of idiosoma completely covered by an entire shield bearing 37 (z1 and z3 lacking), 38 (z3 lacking) or 39 pairs of fine, simple, setae. Unpaired accessory setae may be present in the region of the *J* series.

Tritosternum normal, bipartite. Pre-endopodal shields conspicuous. Sterno-metasternal shield in the female with four pairs of setae and three pairs of pores. Genito-ventro-anal shield large, bearing four to six pairs of setae excluding the anals, and free or fused by way of the metapodal shields with the peritrematal shields. Male with holoventral shield free or fused with the peritrematal shields. Podal shields strongly developed behind coxae IV.

Segmental chaetotaxy of the legs normal.

Two groups of species appear to be represented within the genus, namely, the *veneta* group in which the peritrematal shields are fused by way of the metapodal shields with the genito-ventral shield of the female, the spermathecal ducts are heavily sclerotized and conspicuous and the spermadactyl groove is sinuous, and the *placentula* group in which the peritrematal shields are free posteriorly in the female, there are no distinct spermathecal ducts and the spermadactyl groove is straight. There is also a tendency in the *veneta* group towards hypotrachy of the podonotum in the adult.

Three species are represented in the British fauna and they appear to favour damp habitats.

KEY TO FEMALES

- 1 Paraverticlar seta (z1) absent, dorsal shield with 37 pairs of setae (Text-fig. 50A); spermathecal ducts as in Text-fig. 50E; genito-ventro-anal shield normally with four pairs of setae excluding anals (Text-fig. 50F)
O. sellnicki Bregetova & Koroleva (p. 231)
- Paraverticlar setae (z1) present, dorsal shield with 38 or 39 pairs of setae 2
- 2 Spermathecal ducts conspicuous (Text-fig. 49C); peritrematal shield fused with the podal and genito-ventro-anal shields (Text-fig. 49B and D); with 38 pairs (z3 absent) of relatively short dorsal setae (Text-fig. 49A). *O. veneta* (Berlese) (p. 231)
- Spermathecal duct apparently absent; peritrematal shield free posteriorly (Text-fig. 52F); with 39 pairs of long, fine, dorsal setae (Text-fig. 52A)
O. placentula (Berlese) (p. 235)

KEY TO MALES

- 1 Spermadactyl groove straight (Text-fig. 52B); genu III with seta *pv* modified into a rounded protuberance (Text-fig. 52C); dorsal shield with 39 pairs of setae
O. placentula (Berlese) (p. 237)
- Spermadactyl groove sinuous (Text-fig. 51B and D); genu III with seta *pv* normal; dorsal shield with 37 or 38 pairs of setae 2
- 2 Paraverticlar setae absent *O. sellnicki* Bregetova & Koroleva (p. 233)
- Paraverticlar setae present *O. veneta* (Berlese)

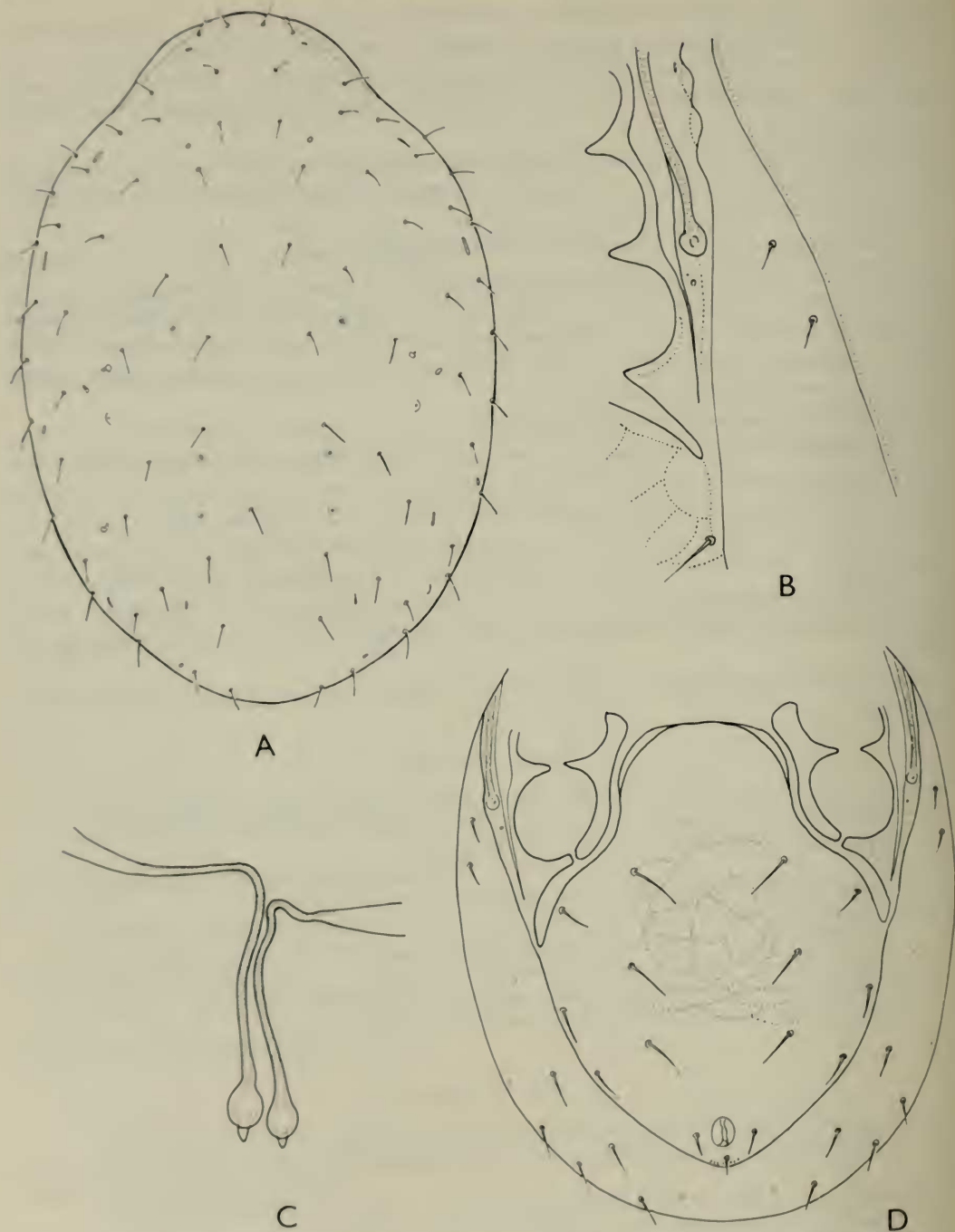


FIG. 49. *Ololaelaps veneta* (Berlese), female; dorsum of idiosoma (A); peritrematal-podal shields in region of coxa IV (B); "spermathecal ducts" (C); genito-ventro-anal shield (D).

Ololaelaps veneta (Berlese)

Laelaps tumidulus (Koch) Berlese, 1889, *Acari, Myr. Scorp. Ital.* fasc. 44, no. 5.

Hypoaspis venetus Berlese, 1903, *Zool. Anz.* **27** : 14 (nom. nov. pro *Laelaps tumidulus* Berlese, 1889 nec Koch).

Ololaelaps venetus Berlese, 1904, *Redia* **1** : 260.

Ololaelaps halaskovae Bregetova & Koroleva, 1964, *Parazit. Sb.* **22** : 81, figs. (**syn. nov.**).

Female : Chelicerae with segment I, 75 μ ; II, 150 μ ; movable digit 87 μ , bidentate ; fixed digit tridentate ; pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about 57 μ apart ; *hyp.2* about 48 μ apart. Deutosternum with six transverse rows of denticles (3–6 denticles per row) ; corniculi 45 μ long ; internal malae as in *O. sellnicki*. Tectum capituli with anterior margin finely denticulate. Salivary styli conspicuous. Pedipalp (2–5–6–14) with three-tined apotele.

Dorsal shield (672–804 $\mu \times$ 444–456 μ) with 38 pairs of relatively short, simple setae distributed as in Text-fig. 49A, seta *z3* being absent. An unpaired accessory seta is present between the *J* series. Surface of shield granular with sculptured areas in the podonotal region.

Tritosternum with base 30 μ , laciniae 81 μ . Sterno-metasternal shield (102 $\mu \times$ 132 μ) with four pairs of setae and three pairs of pores. Between *st1*, 66 μ ; between *st1* and *st3*, 87 μ . Genito-ventro-anal shield (270 $\mu \times$ 258 μ) with six pairs of setae, excluding the anals. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 49D. Peritreme extends to posterior fourth of coxa I. Peritrematal shield fused with podal shield and with genito-ventro-anal shield (Text-fig. 49B). Spermathecal ducts as in Text-fig. 49C.

Legs with normal chaetotaxy. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	81/36	72/50	54/38	75/40
tibia	87/32	60/45	54/36	75/38
tarsus	153/30	102/34	105/30	135/33

Male : Described and figured by Bregetova & Koroleva (1964).

HABITAT : In moss, Britain and Italy, and in nests of small mammals U.S.S.R.

Ololaelaps sellnicki Bregetova & Koroleva

Ololaelaps haemisphaericus (Koch), Sellnick, 1940, *Göteborgs Vetensk. Samh. Handl.* (5B), **6** (14) : 69, fig. 48.

Ololaelaps sellnicki Bregetova, 1964, *Parazit. Sb.* **22** : 77, figs. (nom. nov. pro *Ololaelaps haemisphaericus* Sellnick, 1940 non Koch, 1839).

Female : Chelicera with segment I, 102 μ ; II, 204 μ ; movable digit 87 μ , bidentate ; fixed digit tridentate ; pilus dentilis short, setiform (Text-fig. 50C). Four

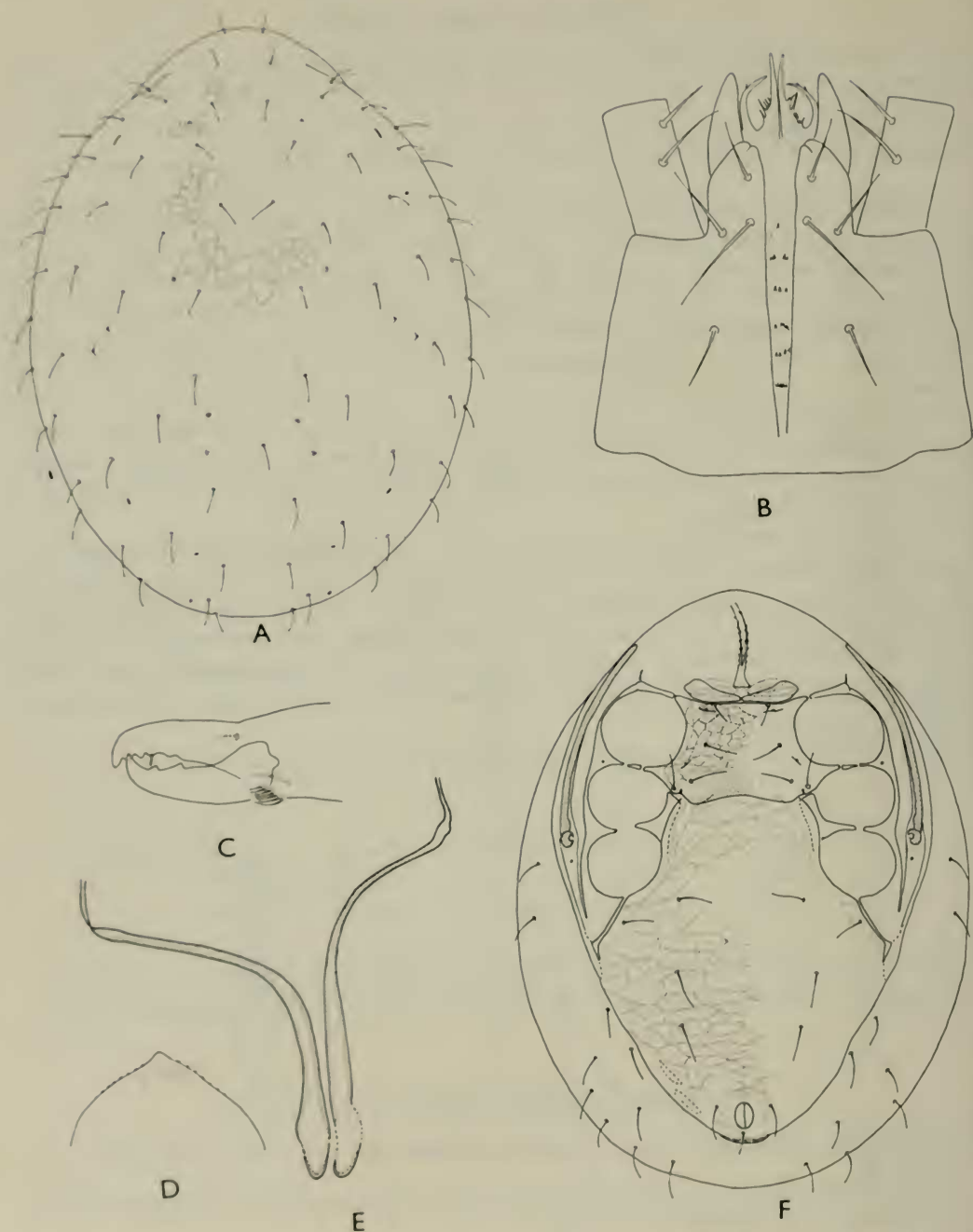


FIG. 50. *Ololaelaps sellnicki* Bregetova, female; dorsum of idiosoma (A); venter of gnathosoma (B); chelicera (C); tectum capituli (D); "spermathecal ducts" (E); venter of idiosoma (F).

pairs of gnathosomal setae with *c.s.* about 60 μ apart, *hyp.2* about 48 μ apart. Deutosternum with six transverse rows of denticles (1-5 per row); corniculi 60 μ long; internal malae as in Text-fig. 50B. Tectum capituli with anterior margin very finely denticulate (Text-fig. 50D). Salivary styli conspicuous. Pedipalp (2-5-6-14) with three-tined apotele.

Dorsal shield (636 $\mu \times$ 480 μ) with 37 pairs of simple, subequal setae distributed as in Text-fig. 50A, setae *z1* and *z3* being absent. A single accessory seta is present between the *J* series. Surface of shield granular with sculptured areas in the podonotal region.

Tritosternum with base 24 μ , laciniae 66 μ . Sterno-metasternal shield (102 $\mu \times$ 132 μ) with four pairs of setae and three pairs of pores. Between *st1*, 60 μ ; between *st1* and *st3*, 87 μ . Genito-ventro-anal shield (264 $\mu \times$ 264 μ) with four pairs of setae in the preanal region. Paranal setae 36 μ , postanal seta 21 μ . Chaetotaxy of opisthogaster as in Text-fig. 50F. Peritreme extends to middle of coxa I; anterior part of peritrematal shield fused with dorsal shield, posterior part fused with podal shield behind coxa IV and with genito-ventro-anal shield. Spermathecal ducts as in Text-fig. 50E.

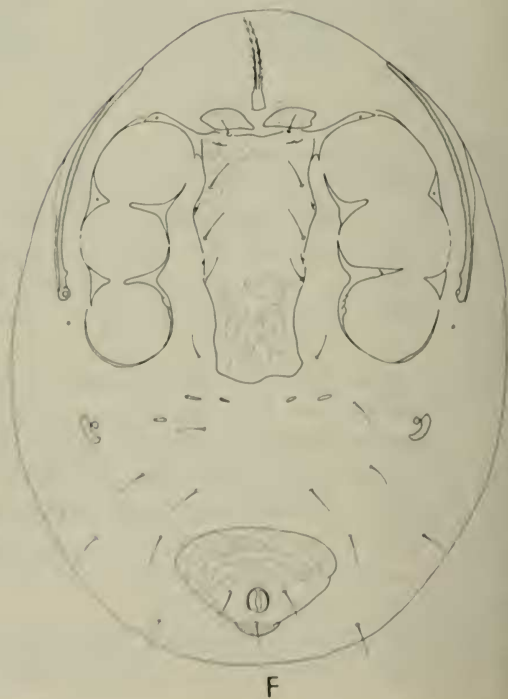
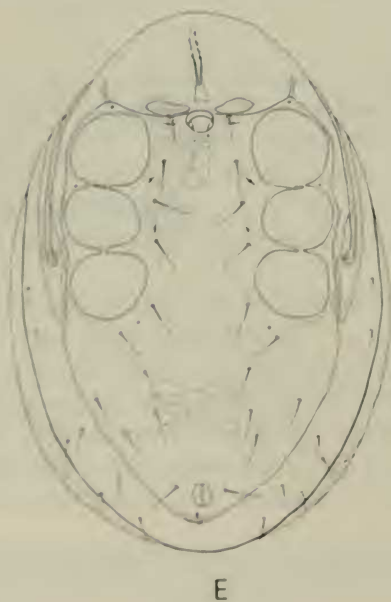
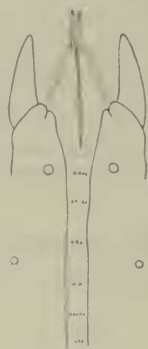
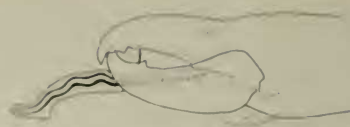
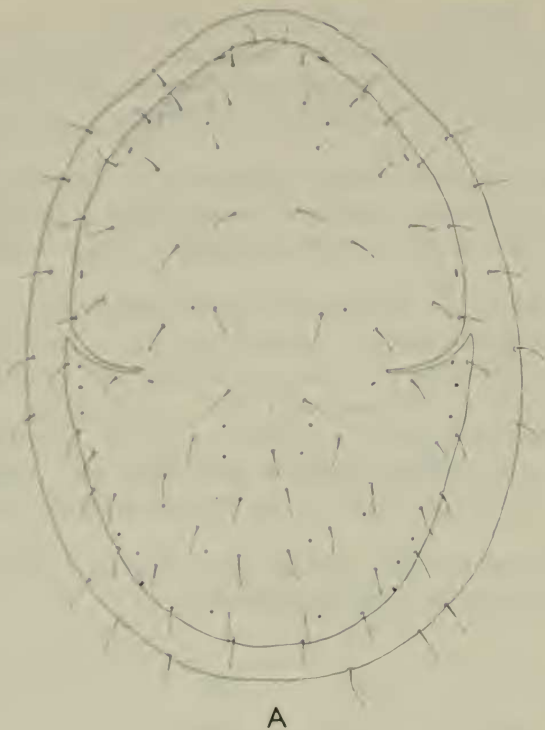
Legs with normal chaetotaxy. Tarsus II with ventral setae inflated basally, tapering to long, fine points. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	90/40	75/50	63/42	84/45
tibia	102/36	72/48	60/40	80/42
tarsus	168/32	126/40	114/36	156/36

Male: Chelicera with segment I, 60 μ ; 282 μ ; movable digit 63 μ (102 μ with spermadactyl), unidentate; groove of spermadactyl with sinuous margins (Text-figs. 51 B and D); fixed digit unidentate, pilus dentilis short, setiform. Four pairs of gnathosomal setae with *c.s.* about 50 μ apart, *hyp.2* about 45 μ apart. Deutosternum with six transverse rows of denticles (2-5 per row); corniculi 48 μ long; internal malae fringed (Text-fig. 51C). Tectum, salivary styli and pedipalps as in female.

Dorsal shield (516 $\mu \times$ 360 μ) with 37 pairs of setae and one unpaired accessory seta. Tritosternum with base 15 μ , laciniae 57 μ . Holoventral shield (408 $\mu \times$ 93 μ) expanded behind coxae IV and fused with podal shields; with four pairs of setae and three pairs of pores in the sternal region, six pairs of setae in the genito-ventral region. Between *st1*, 54 μ ; between *st1* and *st3*, 87 μ . Paranal setae 27 μ , postanal seta 9 μ . Chaetotaxy of opisthogaster as in Text-fig. 51E. Peritreme extends to about middle of coxa I; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Legs with normal chaetotaxy. Tarsus II with seta *pv*₂ strongly inflated basally, terminating in a fine point. Length/width (in μ) of leg segments:



	I	II	III	IV
genu	75/33	66/45	48/36	66/36
tibia	81/30	60/42	48/33	69/36
tarsus	144/27	108/36	99/30	132/30

Deutonymph : Chelicera with segment I, 72 μ ; II about 160 μ ; movable digit 66 μ . Four pairs of gnathosomal setae with c.s. about 60 μ apart, *hyp.2* about 48 μ apart. Deutosternum with six transverse rows of denticles (3–6 per row) ; corniculi 40 μ long. Internal malae and pedipalps as in female.

Dorsal shield (624 μ $\times$ 396 μ) with lateral incisions, bearing 34 pairs of setae ; setae *z1* and *z3* absent ; setae *s3*, *s6* and humeral seta on cuticle (Text-fig. 51A). Opisthonotal region with one accessory seta ; five pairs of *R* setae on the cuticle. Tritosternum with base 20 μ , laciniae 50 μ . Sternal shield (246 μ $\times$ 105 μ) with four pairs of setae and three pairs of pores. Between *st1*, 60 μ ; between *st1* and *st3*, 102 μ . Anal shield (96 μ $\times$ 110 μ) with maximum width 162 μ ; paranal setae 27 μ ; postanal seta 18 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 51F. Peritreme extends to middle of coxa I ; anterior part of peritrematal shield free, extending a short distance beyond tip of peritreme ; posterior part not developed.

Legs with normal chaetotaxy. Tarsus II with setae *av* and *pv* stout basally, tapering to long, fine points. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	75/42	70/50	50/42	72/45
tibia	87/36	60/45	48/40	72/42
tarsus	150/33	93/40	105/33	144/40

HABITAT : Found in moss and decaying organic matter in Britain, Europe and Iceland.

NOTE : Bregetova & Koroleva (1964) have figured the dorsum of *O. sellnicki* with paravertical setae. Dr. Bregetova has kindly re-examined her specimens at our request and has confirmed that the paraverticals are actually absent as in our material.

Ololaelaps placentula (Berlese)

Laelaps placentula Berlese, 1887, *Acari, Myr. Scorp. Ital.* fasc. 44, no. 3.

Ololaelaps placentula: Sellnick, 1940, *Göteborgs Vetensk. Samh. Handl.* (5B), 6 (14): 69, fig. 49;

Bregetova & Koroleva, 1964, *Parazit. Sb.* 22: 70, figs.

Ololaelaps confinis Berlese, 1904, *Redia* 1: 261.

Female : Chelicera with segment I, 90 μ ; II, 192 μ ; movable digit 102 μ , bidentate ; fixed digit with three teeth, two of which are very small and rounded ; pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about 66 μ apart,

FIG. 51. *Ololaelaps sellnicki* Bregetova. A. Dorsum of idiosoma of deutonymph ; B. chelicera of male, internal view ; C. deutosternum and hypostome of male ; D. chelicera of male, dorsal view ; E. venter of idiosoma of male ; F. venter of idiosoma of deutonymph.

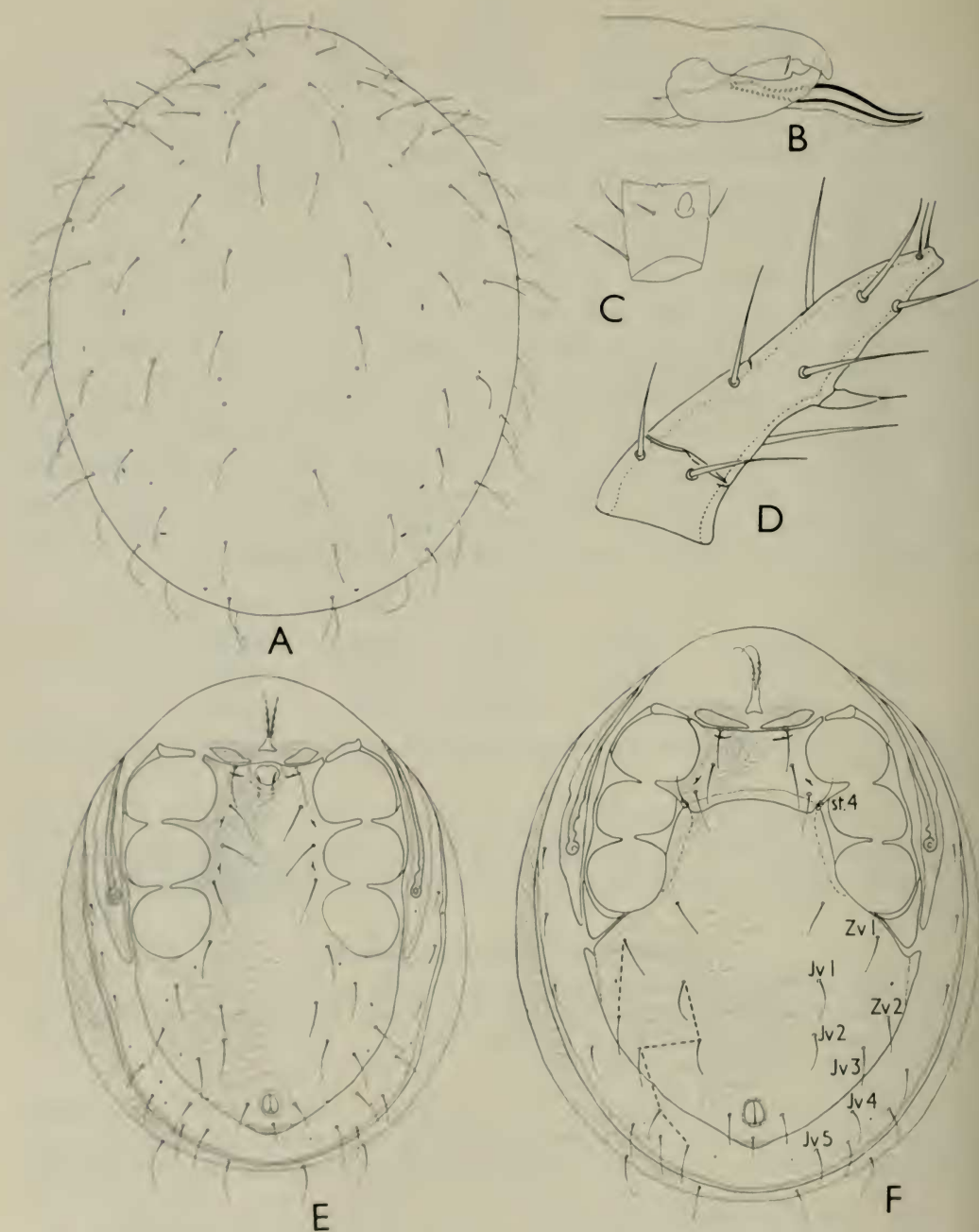


FIG. 52. *Ololaelaps placentula* (Berlese). A. Dorsum of idiosoma of female; B. chelicera of male; C. genu III of male; D. tarsus II of male; E. venter of idiosoma of male; F. venter of idiosoma of female.

hyp.2 about $57\ \mu$ apart. Deutosternum with six transverse rows each of many denticles; corniculi $63\ \mu$; internal malae and tectum capituli as in *I. sellnicki*. Salivary styli conspicuous, extending almost to tips of corniculi. Pedipalp (2-5-6-14) with three-tined apotele.

Dorsal shield (approximately $732\ \mu \times 540\ \mu$) with 39 pairs of simple setae distributed as in Text-fig. 52A; Surface of shield granular, with faint reticulations; no hypertrichy.

Tritosternum with base $27\ \mu$, laciniae $84\ \mu$. Sternal shield ($80\ \mu \times 132\ \mu$) with four pairs of setae and three pairs of pores. Between *st1*, $80\ \mu$; between *st1* and *st3*, $84\ \mu$. Genito-ventro-anal shield ($288\ \mu \times 252\ \mu$) expanded behind coxae IV, but not fused with podal or peritrematal shields; with six pairs of setae in the preanal region. Paranal setae $36\ \mu$, postanal seta $30\ \mu$. Chaetotaxy of opisthogaster as in Text-fig. 52F. Peritreme extends to about middle of coxa I; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Legs with normal chaetotaxy; tarsus II with ventral setae relatively stout basally, tapering to long, fine points. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	93/42	75/54	63/45	78/45
tibia	96/36	66/50	54/42	75/45
tarsus	165/33	126/42	120/38	160/38

Male: Chelicera with segment I, $75\ \mu$; II, $165\ \mu$; movable digit $75\ \mu$ ($123\ \mu$ with spermadactyl), unidentate; margins of spermadactyl groove smooth (Text-fig. 52B); fixed digit unidentate, pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about $60\ \mu$ apart, *hyp.2* about $50\ \mu$ apart. Deutosternum with seven transverse rows each of many denticles; corniculi $54\ \mu$ long; hypostomal processes consist of a pair of slender, pilose triangles. Tectum capituli, salivary styli and pedipalps as in female.

Dorsal shield ($570\ \mu \times 460\ \mu$) with 39 pairs of setae as in female. Tritosternum with base $21\ \mu$, laciniae $63\ \mu$. Holoventral shield ($420\ \mu \times 123\ \mu$) expanded behind coxae IV, fused with podal but not with peritrematal shields; with four pairs of setae and three pairs of pores in the sternal region, six pairs of setae in the genito-ventral region. Between *st1*, $70\ \mu$; between *st1* and *st3*, $93\ \mu$. Paranal setae $33\ \mu$, postanal seta $24\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 52E. Peritreme extends beyond posterior margin of coxa I; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Legs with normal chaetotaxy. Genu III with seta *pv* reduced to a small "pimple" situated on a protuberance of the segment (Text-fig. 52C). Tarsus II with seta *pv*₂ inflated basally, tapering to a long, fine point (Text-fig. 52D). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	75/36	78/50	60/42	72/42
tibia	84/33	66/45	57/40	75/40
tarsus	150/30	132/35	117/34	144/38

Immature stages: The larva, protonymph and deutonymph of this species are described and figured by Bregetova & Koroleva (1964).

HABITAT: Found in moss and decaying organic matter in Britain, Europe and Iceland. Recorded from the nests of small mammals in the U.S.S.R.

Subfamily **HAEMOGAMASINAE** Oudemans

Haemogamasidae Oudemans, 1926, *Ent. Ber. Amst.* 7 (150): 120.

Adults: Chelicerae chelate, dentate or edentate; in dentate forms movable digit in the female bidentate, in the male unidentate. In some *Brevisterna* fixed digit in both sexes weakly sclerotized and transversely striated, movable digit of female with conspicuous hyaline lobe. Pilus dentilis simple or inflated; dorsal seta conspicuous, rarely reduced to a microseta or absent; fissures normal. Arthrodial processes present or absent, arthrodial membrane sometimes lobate (*Haemogamasus*). Sperma-dactyl grooved, relatively short, free distally but closely associated with the movable digit. Chaetotaxy of venter of gnathosoma normal. Pedipalps with five free segments, apotele two- or three-tined; chaetotaxy normal (2-5-6-14). Palptrochanter rarely with weak medio-ventral ridge; with sensory organ in *Eulaelaps*. Deuto-sternum with ten or more transverse rows of denticles; denticles rarely in single file (*Brevisterna*). Corniculi horn-like, in the form of flattened lobes or membranous. Internal malae usually bipartite and conspicuous. Tectum capituli fimbriated and overhanging the hypostome, or weakly sclerotized with smooth margins (*Brevisterna*).

Dorsum of idiosoma in both sexes with entire shield or with abbreviated shield and a small setae-bearing pygidial shield in the female (*Brevisterna*). Primary chaetotaxy completely obliterated by secondary hypertrichy of both the dorsal shield and the unsclerotized cuticle. Dorsal setae simple or pilose.

Tritosternum normal, laciniae pilose; lateral margins of basal region rarely denticulate (*Eulaelaps*). Sternal shield in the female normally with three pairs of setae and two pairs of pores, but with accessory setae in some species of *Haemogamasus*; shield reduced and bearing only two pairs of setae and two pairs of pores in *Brevisterna*. Metasternal setae free. Genito-ventral shield usually with numerous setae. Anal shield normal or with accessory setae, opisthogastric cuticle showing hypertrichy. Metapodal shields large, subtriangular or subovate (*Eulaelaps*) or relatively small. Peritrematal shields free or fused with the podal shields posterior to coxae IV. Stigmata normal, peritremes well developed or reduced. Podal shields weakly developed. Male with holovenral shield, with or without accessory setae in the sternito-genital region, opisthogastric region densely setose; or with sternito-genito-ventral and anal shields (*Ischyropoda*). Genital orifice presternal.

Segmental chaetotaxy of legs normal except for genu IV ($2-\frac{2}{1}$, $\frac{3}{0}-2$) in all species and rarely (*H. hirsutosimilis*) femur II ($2-\frac{5}{4}-1$) and femur III ($1-\frac{3}{2}-1$). Anterior spine on coxa II small or absent. Ambulacra with claws sometimes reduced on leg I. Femur II with one or more ventral setae hypertrophied in some males.

Larva and Protonymph: Insufficient data are available on these stages for their definition. Both stages have been described for *Haemogamasus ambulans*: Keegan,

1951, by Furman (1959). Hypertrichy of the idiosoma is apparent at the protonymphal stage in *Haemogamasus*.

Deutonymph: Gnathosoma with the general characteristics of the female. Dorsal idiosomal sclerotization comprising a single shield with (*Eulaelaps* and *Haemogamasus*) or without (*Ischyropoda*) lateral incisions, or an abbreviated dorsal shield (podonotal) with mesonotal scutellae and fragments of the pygidial shield (*Brevisterna*). Dorsal chaetotaxy shows marked hypertrichy.

Tritosternum as in female. Sternito-genital shield with three pairs of sternal and one pair of metasternal setae, genital setae free, or with numerous accessory setae. Anal shield normal or with accessory setae; opisthogastric cuticle showing hypertrichy. Podal shields usually small. Peritrematal shields free posteriorly; stigmata and peritremes as in adult.

Leg chaetotaxy as in corresponding adult.

KEY TO THE GENERA OF THE BRITISH HAEMOGAMASINAE

- 1 Female with metapodal shields large, subtriangular, and flanking a broad genito-ventral shield; palptrochanter with sensory organ (Text-fig. 62F); anterior rows of deutosternal denticles with 5 to 7 denticles per row in both sexes

EULAEELAPS (p. 259)

- Female with metapodal shields small, sub-ovate; genito-ventral shield relatively narrow; palptrochanter lacking sensory organ; anterior rows of deutosternal denticles with two to three denticles per row in both sexes

HAEMOGAMASUS (p. 239)

Genus **HAEMOGAMASUS** Berlese

Liponissus Kolenati, 1858, *Wien. ent. Monatschr.* **2**: 5.

Liponyssus Kolenati, 1859, *S.B. Akad. Wiss. Wien.* **35**: 172.

Haemogamasus Berlese, 1889, *Acar., Myr. Scorp. Ital.* fasc. 52, nos. 2 and 10.

Euhaemogamasus Ewing, 1933, *Proc. U.S. nat. Mus.* **82** (art. 30): 3.

Groschäftella Samsinak, 1957, *Cslka. parasitol.* **4**: 270 (**syn. nov.**).

Type: *Haemogamasus hirsutus* Berlese, 1889.

Chelicerae chelate-dentate, rarely edentate; pilus dentilis simple or inflated; dorsal seta long, stout, rarely absent. Dorsal and anti-axial fissures conspicuous. Spermadactyl short, closely associated with the movable digit. Tectum fimbriated and overhanging the hypostome. Basis capituli with a pair of capitular setae; hypostome with the normal three pairs of setae. Deutosternum with 10-18 transverse rows of denticles. Internal malae bipartite, conspicuous. Corniculi horn-like or in the form of flattened lobes. Salivary styli well developed. Pedipalps with normal chaetotaxy; apotele two- or three-tined.

Dorsum of idiosoma with marked hypertrichy which completely obliterates the primary chaetotaxy. Dorsal shield entire in both sexes; dorsal setae simple or pilose.

Tritosternum normal, pilose laciniae about three times the length of the base. Sternal shield in the female with the normal three pairs of setae and two or three pairs of pores; with accessory setae in some species. Metasternal setae free. Genito-

ventral shield flask-shaped with numerous setae. Anal shield pear-shaped, with the usual three setae associated with the anus, and with or without accessory setae. Opisthogastric integument densely setose. Metapodal shields small, peritrematal shield fused with expodal shield in the region of coxa IV. Male with holoventral shield, with or without accessory setae in the sternito-genital region; opisthogastric region of shield densely setose.

Segmental chaetotaxy of legs normal except for genu IV ($2-\frac{2}{1}, \frac{3}{0}-2$) and tibia IV ($2-\frac{2}{1}, \frac{2}{1}-2$) in all species and femur II ($2-\frac{5}{4}-1$) and femur III ($1-\frac{3}{2}-1$) in *H. hirsutosimilis*.

The type of the genus *Liponyssus* Kolenati (*Liponyssus setosus* Kolenati, 1858) was so poorly described and figured that its identity has always been in doubt. In earlier standard works on the obligatory ectoparasitic "Laelaptidae" the genus was widely used to accommodate certain species now included in the Macronyssinae and Ewing (1923) proposed the subfamily Liponyssinae for *Liponyssus* sensu authors and certain related genera. Oudemans (1936) considered *L. setosus* to be "a totally different sort of mite" from the other species included in *Liponyssus* by authors, the majority of which were placed by him in *Macronyssus* for which he proposed the family Macronyssidae. Although certain authors have continued to use *Liponyssus* and Liponyssinae since Oudemans (1936) the general tendency has been for the suppression of *Liponyssus* sensu authors, especially since Fonseca's revisionary work in 1948.

A single damaged specimen, probably the type, of *Liponyssus setosus* Kolenati has recently been found in the Kolenati collection in Paris. This species is a male of *Haemogamasus horridus* Michael. The strict application of the Rules of Priority would necessitate the synonymizing of *Haemogamasus* Berlese with *Liponyssus* Kolenati. However this course would be contrary to the interests of nomenclatural stability especially since *Haemogamasus* and suprageneric taxa based upon it are so well established in the literature. We propose to submit an application to the International Commission on Zoological Nomenclature requesting its use of the plenary powers to suppress the genus *Liponyssus* Kolenati, 1858, its type species and the suprageneric categories based on the name *Liponyssus*.

KEY TO FEMALES

- | | | |
|---|---|---------------------------------|
| 1 | Sternal shield with the normal three pairs of setae only | 2 |
| - | Sternal shield with accessory setae which are usually shorter than the primary sternal setae and vary in size, number and position on the shield | 5 |
| 2 | Posterior margin of the sternal shield deeply incised to a level midway between the first and second pairs of sternal setae (Text-fig. 60B). Anal shield usually with only the normal three setae. Dorsal and ventral surface of the idiosoma less densely setose than in the following species (Text-figs. 60A-B). <i>H. pontiger</i> (Berlese) (p. 257) | |
| - | Posterior margin of sternal shield at the most slightly concave (Text-fig. 59B). Anal shield with several accessory setae | 3 |
| 3 | First pair of sternal setae and hypostomal setae barbed. Dorsal shield, especially in the anterior and marginal regions, with many barbed setae. Tectum capituli narrow, pointed, with simple and multiple fimbriae. Pilus dentilis inflated (Text-fig. 59E). | <i>H. nidi</i> Michael (p. 254) |

- Sternal, hypostomal and dorsal setae smooth. Tectum capituli with gently rounded margin of simple and multiple fimbriae. Pilus dentilis short, setiform (Text-figs. 57A and C) 4
- 4 Postero-ventral margin of the idiosoma with at least one pair of setae conspicuously longer than the rest (Text-fig. 58B); sternal shield about as wide as long; genito-ventral shield with 60 or more setae; deutosternal denticles as in Text-fig. 58D. Associated with *Talpa* (Insectivora) **H. horridus** Michael (p. 252)
- Postero-ventral margin of the idiosoma with setae subequal (Text-fig. 56B); sternal shield about $1\frac{1}{2}$ times wider than long; genito-ventral shield with about 40-45 setae; deutosternal denticles as in Text-fig. 56F. Associated with Muridae (Rodentia) **H. arvicolarum** (Berlese) (p. 250)
- 5 Femur II with 12 setae ($2-\frac{5}{4}-1$), femur III with seven setae ($1-\frac{3}{2}-1$). One pair of extremely long postero-ventral idiosomal setae about three times the length of the neighbouring setae (Text-fig. 55C) **H. hirsutosimilis** Willmann (p. 246)
- Femur II with 11 setae ($2-\frac{5}{3}-1$), femur III with six setae ($1-\frac{3}{1}-1$). Without very long postero-ventral idiosomal setae; longest pair at the most twice the length of the neighbouring setae 6
- 6 Chelae dentate; palptrochanter with both setae pilose, not inflated. Genito-ventral shield with accessory setae restricted mainly to the posterior region. Many setae barbed (*st1*, *hyp.* 2-3, *c.s.*, many dorsal setae and most setae on the appendages). Dorsal setae uniform in size except at anterior and posterior margins. Anal shield wider than long **H. ambulans** (Thorell) (p. 244)
- Chelae edentate; palptrochanter with inner seta inflated basally. Genito-ventral shield with accessory setae evenly distributed over entire surface. All setae smooth. Dorsal shield with large and small setae interspersed over its entire surface. Anal shield longer than wide **H. hirsutus** Berlese (p. 242)

KEY TO MALES

- 1 Sternal region of holovenral shield with no accessory setae anterior to the level of the second pair of pores 2
- Holovenral shield with accessory setae distributed over the entire surface 5
- 2 First pair of sternal setae smooth (Text-fig. 58C). Tectum capituli with gently rounded margin of simple and multiple fimbriae. Chelicera with dorsal seta distinctly distal to base of fixed digit 3
- First pair of sternal setae barbed (Text-fig. 59C). Tectum capituli tapering, pointed, with fimbriate margin. Chelicera with dorsal seta proximal to base of fixed digit 4
- 3 Femur II with *av*₁ short, spinose, conspicuously different from other ventral setae (Text-fig. 56E). Postero-ventral idiosomal setae subequal (Text-fig. 56D). Spermadactyl without retrose spur (Text-fig. 57D) **H. arvicolarum** Berlese (p. 251)
- Femur II with *av*₁ setiform, similar to other ventral setae. At least one pair of postero-ventral idiosomal setae conspicuously longer than the neighbouring setae (Text-fig. 58C). Spermadactyl with a stout retrose spur (Text-fig. 57B). **H. horridus** Michael (p. 254)
- 4 Ventral seta on femur III setiform. Holovenral shield with dense covering of setae (Text-fig. 59C). Peritrematal shields fused posteriorly with holovenral shield and with podal elements of coxa IV. Pilus dentilis inflated (Text-fig. 59F) **H. nidi** (Michael) (p. 255)
- Ventral seta on femur III short, spinose. Holovenral shield with relatively sparse covering of setae (Text-fig. 60D). Peritrematal shields free posteriorly. Pilus dentilis slender, setiform (Text-fig. 60E) **H. pontiger** (Berlese) (p. 259)
- 5 First pair of sternal setae barbed **H. ambulans** (Thorell)
- All sternal setae smooth 6

- 6 Femur II with 12 setae (4 ventrals, of which two are blunt and peg-like). A pair of very long setae near posterior end of idiosoma about three times the length of the neighbouring setae. Setae on dorsal shield subequal in size, except at anterior and posterior margins. Fixed digit of chelicera relatively short and broad, with a short, antero-median projection (Text-fig. 55E). *H. hirsutosimilis* Willmann (p. 248)
- Femur II with 11 setae (three ventrals, all stout, pointed, spine-like). No very long setae near posterior end of body, longest seta at the most $1\frac{1}{2}$ times the length of the neighbouring setae. Dorsal shield with large and small setae interspersed over its entire surface. Fixed digit of chelicera relatively long, slender, hook-like, with a prominent median expansion (Text-fig. 53E). *H. hirsutus* Berlese (p. 244)

Haemogamasus hirsutus Berlese

Haemogamasus hirsutus Berlese, 1889, *Acari, Myr. Scorp. Ital.* fasc. 52, no. 2.

Keegan, 1951, *Proc. U.S. nat. Mus.* **101**: 210, fig. 42.

Bregetoova, 1956, *Opred. Faune SSSR.* **61**: 140, figs. 290–293, 322–325.

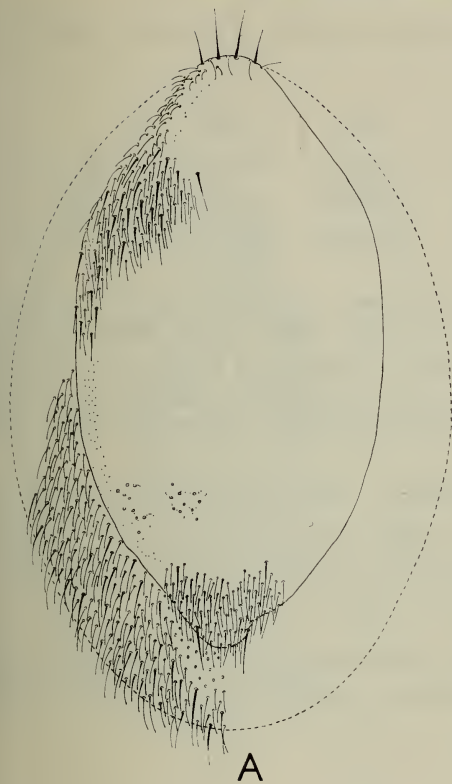
Female: Chelicera with segment I, 144 μ ; II, 300; movable digit 87 μ ; both digits edentate; pilus dentilis short, setiform (Text-fig. 53D), dorsal seta apparently absent. Four pairs of gnathosomal setae with c.s. about 120 μ apart; *hyp.2* about 84 μ apart. Deutosternum with 14 transverse rows of denticles; corniculi membranous, about 63 μ long; internal malae with inner processes slender, pilose, outer processes fimbriate (Evans & Till, 1965, Text-fig. 4C). Tectum capituli narrow, with anterior margin fimbriate. Salivary styli conspicuous, tubular, curved. Pedipalp (2–5–6–14) with three-tined apotele, one being very small; palptrochanter with inner seta inflated basally.

Dorsal shield (1,164 $\mu \times$ 636 μ) densely covered with simple setae of variable length (Text-fig. 53A). Surface of shield granular with some weakly defined reticulations.

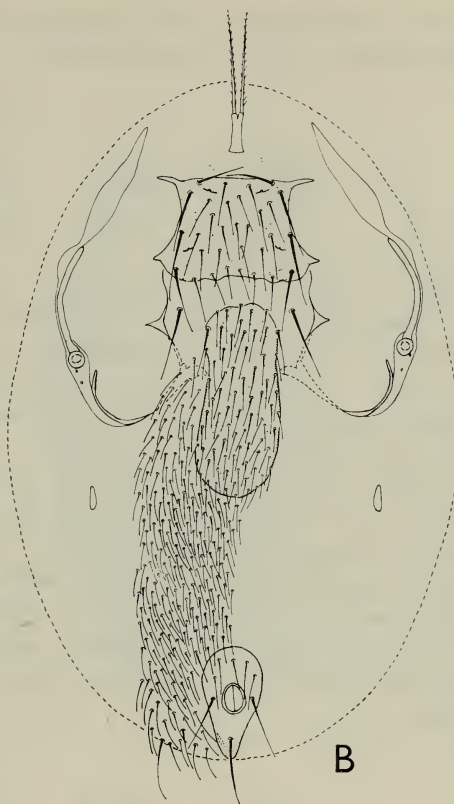
Tritosternum with base 60 μ , laciniae 228 μ ; presternal area reticulate, with minute spines. Sternal shield (174 $\mu \times$ 234 μ) with the usual three pairs of sternal setae and about 25 accessories; with three pairs of pores, the pair usually associated with the metasternal setae being on the posterior margin of the shield; metasternal setae free. Between *st1*, 150 μ ; between *st1* and *st3*, 180 μ . Genito-ventral shield relatively slender with numerous accessory setae distributed over entire shield. Anal shield (168 $\mu \times$ 96 μ) with the usual three setae and five accessories; paranal setae 123 μ , postanal seta 108 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 53B. Peritreme extends to posterior margin of coxa II; peritrematal shield free anteriorly, fused posteriorly with podal shield of coxa IV.

Chaetotaxy of legs differs from normal pattern in that genu IV has two postero-lateral setae and tibia IV has the dorsal setal pattern (2–2) instead of (1–3). All the

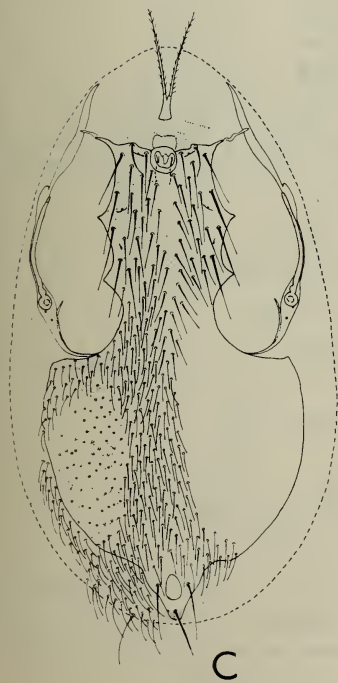
FIG. 53. *Haemogamasus hirsutus* Berlese. A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. venter of idiosoma of male; D. chelicera of female; E. chelicera of male.



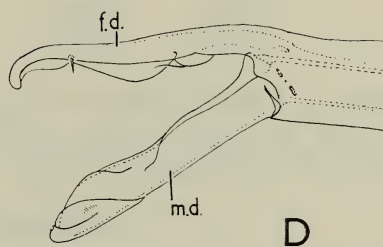
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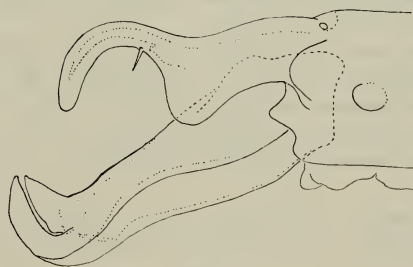
B



C



D



E

leg setae are smooth. Distal margins of most leg segments denticulate ventrally. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	222/60	156/100	150/78	204/72
tibia	228/54	156/90	162/66	222/60
tarsus	330/48	264/66	342/54	498/54

Male : Chelicera with segment I, 114 μ ; II, 222 μ ; movable digit 78 μ (87 μ with spermadactyl) ; both digits edentate (Text-fig. 53E) ; pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about 99 μ apart ; *hyp.2* about 72 μ apart. Deutosternum with 13 transverse rows of denticles ; corniculi 54 μ long. Tectum capituli with anterior and lateral margins fimbriate. Internal malae, salivary styli and pedipalps as in female.

Dorsal shield (1,026 $\mu \times$ 520 μ) as in female. Tritosternum with base 50 μ , laciniae 165 μ . Holoventral shield (840 $\mu \times$ 198 μ) with the usual sternal, metasternal and anal setae recognizable ; accessory setae present over entire surface of shield (Text-fig. 53C). Par- and postanal setae subequal, about 96 μ long. Peritremes and peritrematal shields as in female.

Chaetotaxy of legs as in female ; relatively stouter setae on femur II (ventrals), genu and tibia II (*av*) and tarsus II (*mv* and *av₂*). Length/width (in μ) of leg segments :

	I	II	III	IV
genu	198/54	132/84	114/66	180/60
tibia	204/48	138/78	144/60	204/60
tarsus	264/42	186/54	264/48	414/48

HABITAT : Found in Britain in the nest and on the body of *Talpa europaea* Linn. and on the field vole *Microtus agrestis* (Linn.). Also recorded from a variety of rodents in the U.S.S.R. and Europe.

Haemogamasus ambulans (Thorell)

Dermanyssus ambulans Thorell, 1872, *Öfv. Vet.-Akad. Forh.* **2** : 164.

Hypoaspis ambulans: Trägårdh, 1904, *Fauna Arctica* **4** : 33, figs.

Haemogamasus ambulans: Bregetova, 1953, *Parazit. Sb.* **15** : 316 ; and 1956, *Opred. Faune SSSR* **61** : 147, figs.

Haemogamasus alaskensis Ewing, 1925, *Proc. biol. Soc. Wash.* **38** : 138.

Keegan, 1951, *Proc. U.S. nat. Mus.* **101** : 213, fig. 43.

Haemogamasus avisugus Vitzthum, 1930, *Zool. Jahrb.* **60** : 397.

Haemogamasus sternalis Ewing, 1933, *Proc. U.S. nat. Mus.* **82** : 3, pl. 1, fig. 2.

Haemogamasus pavlovskyi Bregetova, 1949, *Parazit. Sb.* **11** : 179, figs.

Female : Chelicera with segment I, 105 μ ; II, 160 μ ; movable digit 54 μ , bidentate ; fixed digit tridentate ; pilus dentilis setiform ; dorsal seta long and

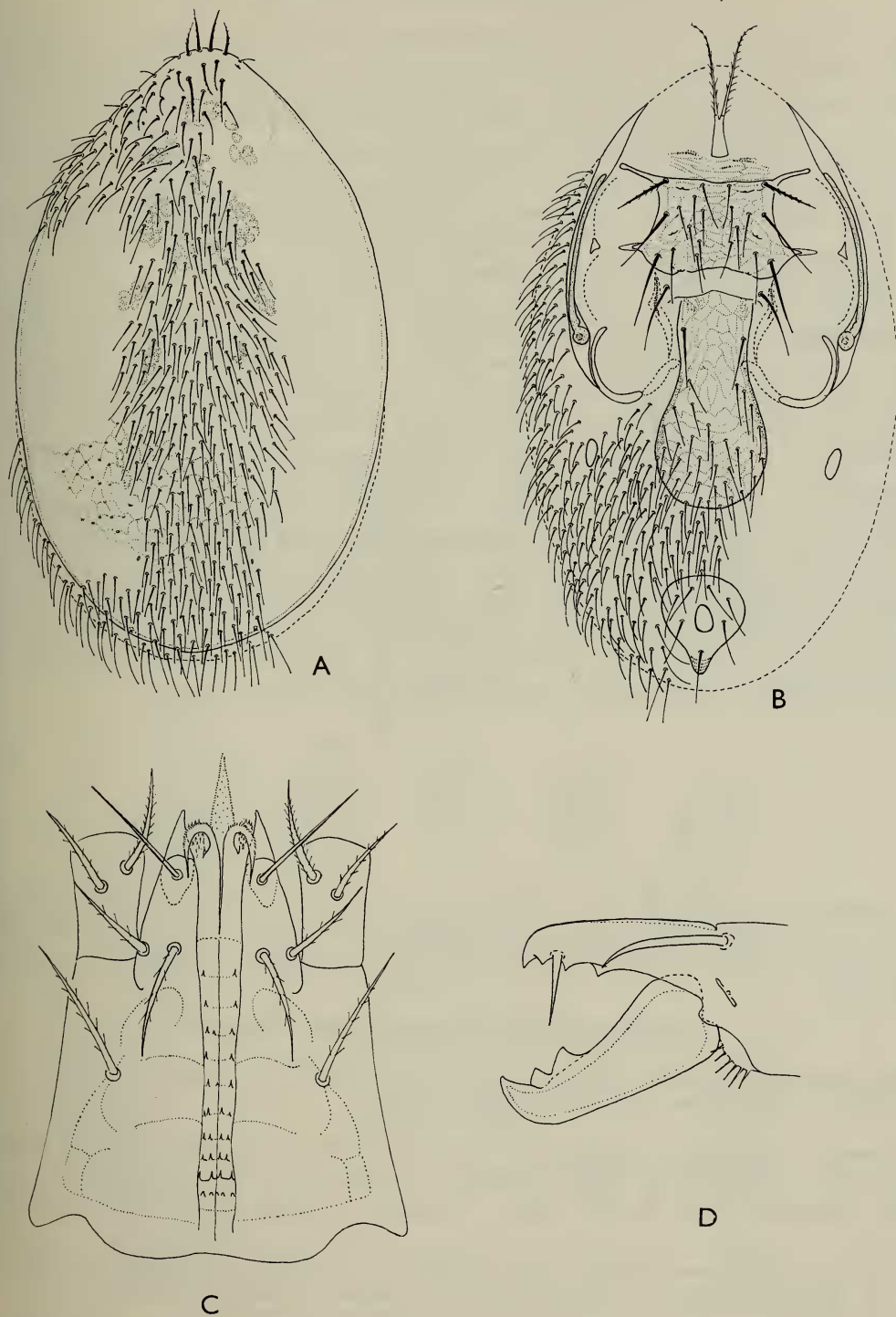


FIG. 54. *Haemogamasus ambulans* (Thorell), female; dorsum of idiosoma (A); venter of idiosoma (B); venter of gnathosoma (C); chelicera (D).

stout (Text-fig. 54D). Four pairs of gnathosomal setae with c.s. about $105\ \mu$ apart, *hyp.2* about $75\ \mu$ apart; *hyp.2-3* and c.s. barbed. Deutosternum with ten transverse rows of denticles (2-5 per row); corniculi $40\ \mu$ long; internal malae as in Text-fig. 54C. Tectum capituli narrow, pointed, fimbriate (Evans & Till, 1965; Text-fig. 3C). Salivary styli conspicuous, extending beyond tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele; both trochantal setae barbed.

Dorsal shield ($1,008\ \mu \times 612\ \mu$) densely covered with setae mostly of uniform length (Text-fig. 54A); some anterior and marginal setae barbed. Surface of shield granular, reticulations most distinct in opisthonotal area.

Tritosternum with base $57\ \mu$, laciniae $150\ \mu$. Sternal shield ($132\ \mu \times 190\ \mu$) with the usual three pairs of sternal setae and about 14 accessories, and with three pairs of pores; metasternal setae free. Between *st1*, $150\ \mu$; between *st1* and *st3*, $120\ \mu$; *st1* barbed. Genito-ventral shield ($276\ \mu \times 120\ \mu$) with a pair of genital setae and about 36 accessories distributed chiefly on the posterior part of the shield. Anal shield ($123\ \mu \times 130\ \mu$) with the usual three anal setae and four or five accessories; paranal setae $68\ \mu$; postanal seta $78\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 54B. Peritreme extends to anterior third of coxa II; peritrematal shield free anteriorly, fused posteriorly with podal shields of coxa IV.

Chaetotaxy of legs differs from normal pattern in that genu IV bears two postero-lateral setae and tibia IV bears two antero- and two postero-dorsal setae. All leg setae barbed except terminal setae on tarsi (*ad*₁, *pd*₁, *av*₁, *pv*₁, *al*₁, *pl*₁, *pv*₂ on tarsi II-IV, as well as *av*₂ on tarsi III-IV, and *mv* on tarsus IV). Distal margins of all segments except tarsi serrated. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	156/54	120/60	114/54	168/50
tibia	168/48	120/57	120/48	180/48
tarsus	228/42	210/45	264/42	372/42

HABITAT: Found in the nest of *Riparia riparia* (Linn.) in Gloucestershire, Britain. Recorded in the literature from the nests of birds, from insectivores, bats, shrews, and a variety of rodents in Germany, the U.S.S.R., Greenland, Spitsbergen and North America.

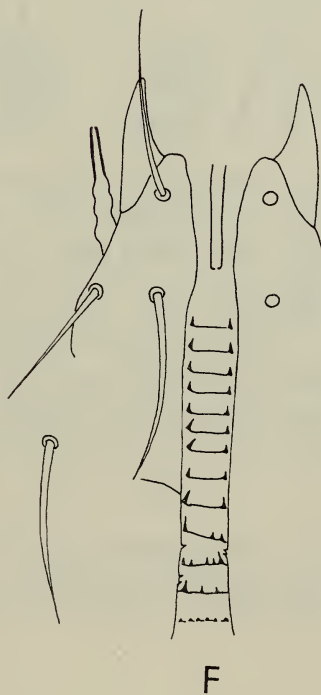
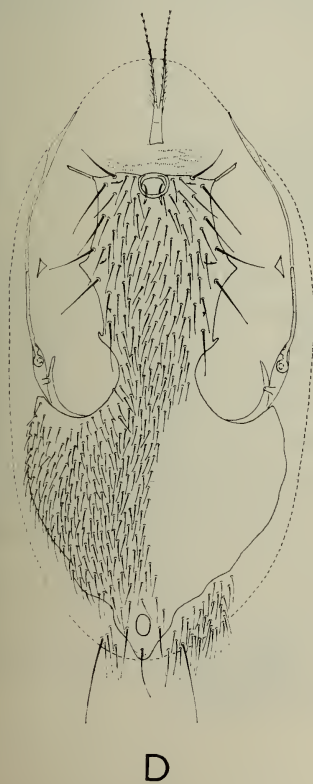
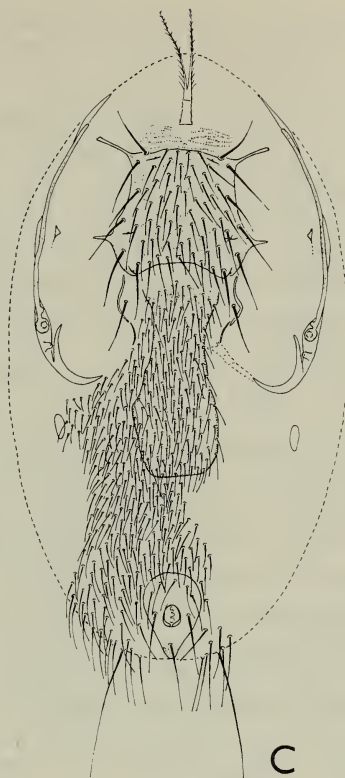
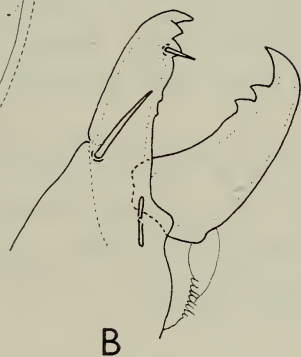
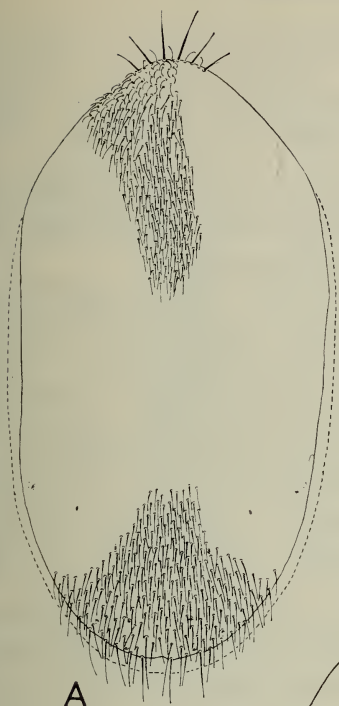
Haemogamasus hirsutosimilis Willmann

Haemogamasus hirsutosimilis Willmann, 1952, *Z. Parasitenk.* **15**: 403, figs.

Bregetova, 1956, *Opred. Faune SSSR*. **61**: 141, figs.

Female: Chelicera with segment I, $84\ \mu$; II, $156\ \mu$; movable digit $60\ \mu$, bidentate; fixed digit with two large and two very small teeth; pilus dentilis short, setiform, dorsal seta long (Text-fig. 55B). Four pairs of simple gnathosomal setae with

FIG. 55. *Haemogamasus hirsutosimilis* Willmann. A. Dorsum of idiosoma of female; B. chelicera of female; C. venter of idiosoma of female; D. venter of idiosoma of male; E. chelicera of male; F. deutosternum and hypostome of female.



c.s. about $96\ \mu$ apart, *hyp.2* about $70\ \mu$ apart. Deutosternum with 13 transverse rows of denticles (2-6 per row) as in Text-fig. 55F. Corniculi $40\ \mu$ long; internal malae with long, pointed inner and short, broad, outer lobes, all pilose. Tectum capituli slender, pointed, deeply denticulate. Salivary styli conspicuous. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield ($1,032\ \mu \times 564\ \mu$) with a dense covering of setae mostly of subequal length, those on the posterior margin being considerably longer; vertical setae long and stout, not barbed (Text-fig. 55A). Surface of shield granular.

Tritosternum with base barbed, $50\ \mu$ long; laciniae $150\ \mu$. Sternal shield ($186\ \mu \times 216\ \mu$) with the usual sternal setae, numerous accessories, and three pairs of pores; metasternal setae free. Between *st1*, $60\ \mu$; between *st1* and *st3*, $174\ \mu$. Genito-ventral shield with numerous setae distributed over its entire surface. Anal shield ($126\ \mu \times 90\ \mu$) with the usual three anal setae and five accessories; paranal setae $110\ \mu$; postanal seta $117\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 55C; a pair of extremely long setae at the posterior end of the body. Peritreme extends nearly to posterior margin of coxa I; peritrematal shield free anteriorly, fused posteriorly with podal shield of coxa IV; pore on posterior shield situated at tip of small tubercle.

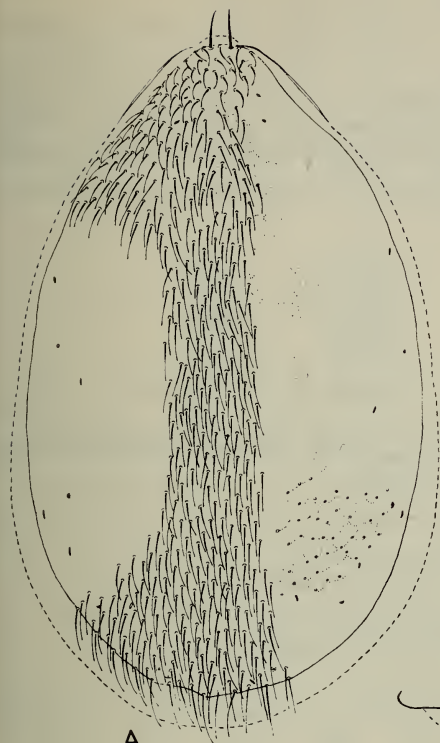
Chaetotaxy of legs differs from the normal pattern in that femur II bears 12 setae (4 ventrals), femur III bears 7 setae (2 ventrals), genu IV bears two postero-lateral setae and tibia IV has two antero- and two postero-dorsal setae; all leg setae simple. Coxae all with rows of denticles on ventral surface; distal margins of all segments except tarsi serrated. Ambulacrum IV nearly one-and-a-half times as long as the others. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	174/54	120/72	108/66	156/60
tibia	180/45	120/63	120/60	168/54
tarsus	240/42	192/50	237/48	318/42

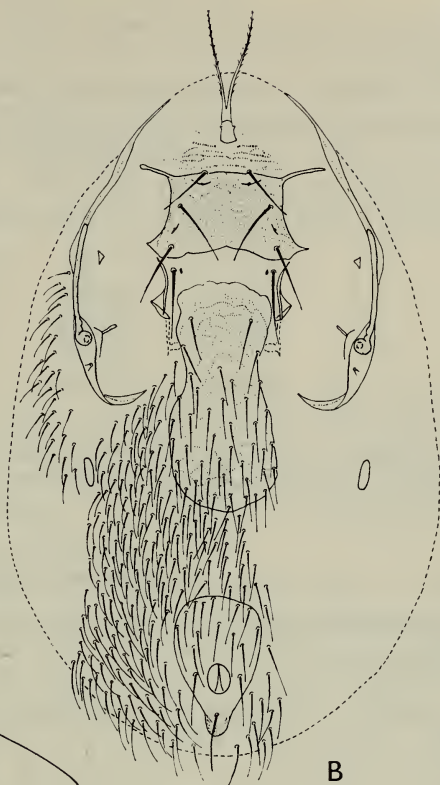
Male: Chelicera with segment I, $60\ \mu$; II, $150\ \mu$; fixed digit short and broad with an anterior projection; movable digit and spermadactyl strongly curved (Text-fig. 55E). Four pairs of gnathosomal setae with c.s. about $85\ \mu$ apart, *hyp.2* about $63\ \mu$ apart. Corniculi $42\ \mu$ long; other gnathosomal features as in female.

Dorsal shield ($780\ \mu \times 438\ \mu$) as in female. Tritosternum with base $33\ \mu$, laciniae $105\ \mu$; presternal area as in female. Holovenral shield $648\ \mu$ long, with a dense covering of accessory setae (Text-fig. 55D); true sternal setae difficult to distinguish. Par- and postanal setae subequal, about $75\ \mu$ long. Peritreme extends to anterior margin of coxa II; anterior tip of peritrematal shield terminates very close to dorsal

FIG. 56. *Haemogamasus arvicolarum* Berlese. A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. corniculus of female, lateral view; D. venter of idiosoma of male; E. femur II of male; F. deutosternum of female.



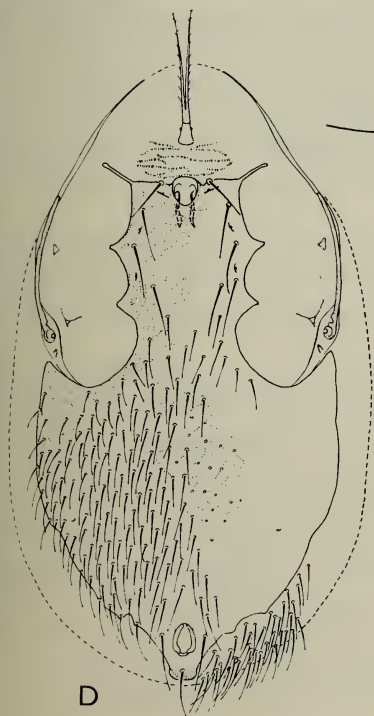
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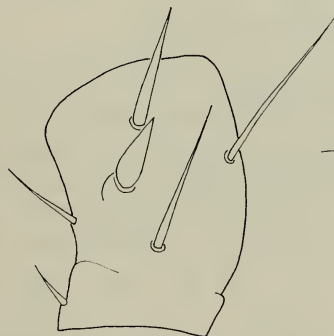
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D



E



F

shield but appears to end freely ; posterior part of shield fused with podal elements of coxa IV.

Chaetotaxy and ornamentation of legs as in female. Stout, blunt, peg-like setae are present on femur II (pv_{2-3}), genu II (av), tibia II (av) and tarsus II (mv); seta av_2 on tarsus II is very stout but pointed. Seta pd_2 on tarsus IV is extremely long, about two-thirds the length of the tarsus. Ambulacrum IV relatively shorter than in female. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	160/48	102/66	96/50	138/54
tibia	156/42	105/57	108/50	150/50
tarsus	207/40	156/42	204/40	270/40

HABITAT : Found in a mole's nest in Gloucestershire, Britain. Recorded from moles, voles and field mice in Europe and the U.S.S.R.

Haemogamasus arvicolarum Berlese

Haemogamasus horridus var. *arvicolarum* Berlese, 1920, *Redia* **14** : 166.

Haemogamasus arvicolarum: Turk, 1945, *Ann. Mag. nat. Hist.* (2) **12** : 785, figs.

Female : Chelicera with segment I, 120 μ ; II, 270 μ ; movable digit 80 μ , bidentate ; fixed digit bidentate with terminal hook ; pilus dentilis short, setiform ; dorsal seta long, stout, blunt (Text-fig. 57C). Four pairs of simple gnathosomal setae with c.s. about 123 μ apart, hyp_2 about 93 μ apart. Deutosternum with 17 transverse rows of denticles (1-4 per row) ; corniculi broad, weakly sclerotized (Text-fig. 56C and F) ; internal malae as in *H. horridus*. Tectum capituli with a rounded anterior margin provided with numerous simple or multiple fimbriae. Salivary styli conspicuous, reaching nearly to tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele ; inner trochantal seta barbed.

Dorsal shield (1,320 $\mu \times$ 840 μ) with a dense covering of subequal setae (Text-fig. 56A). Setae j_1 considerably stouter than the others but not barbed ; a few marginal setae have a minute barb near the tip. Surface of shield granular with sculpturing anteriorly and reticulations posteriorly.

Tritosternum with base 63 μ , laciniae 258 μ ; a small spine on each side of the base. Presternal area with small spines on the reticulations. Sternal shield (156 $\mu \times$ 240 μ) with three pairs of setae and two pairs of pores ; metasternal setae free with associated pores. Between st_1 , 90 μ ; between st_1 and st_3 , 168 μ . Genital shield with about 44 setae distributed mainly on the posterior part. Anal shield (258 $\mu \times$ 138 μ) with maximum width 186 μ , bearing the usual three anal setae and about 13 accessories ; paranal setae 114 μ ; postanal seta 126 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 56B ; some marginal setae barbed. Peritreme extends to posterior margin of coxa II ; peritrematal shield fused anteriorly with dorsal shield and posteriorly with podal shield of coxa IV.

Chaetotaxy of legs differs from normal pattern in that genu IV has two postero-lateral setae and tibia IV has two antero- and two postero-dorsal setae. All leg setae simple. Coxae bear rows of small denticles; distal margins of all segments except tarsi serrated ventrally. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	207/72	168/102	150/84	192/78
tibia	222/66	168/90	168/72	240/72
tarsus	306/60	240/66	330/66	456/66

Male: Chelicera with segment I, 84 μ ; II, 200 μ ; movable digit with sperma-dactyl, 150 μ ; pilus dentilis short, setiform; dorsal seta as in female, but situated a considerable distance distal to the base of the fixed digit (Text-fig. 57D). Four pairs of simple gnathosomal setae with *c.s.* about 105 μ apart; *hyp.2* about 93 μ apart. Deutosternum with 14 transverse rows of denticles (1-3 per row); corniculi 57 μ long; internal malae, tectum and pedipalps as in female.

Dorsal shield (1,092 $\mu \times$ 600 μ) as in female. Tritosternum with spine on each side of base; with base 60 μ , laciniae 210 μ . Presternal area with small spines on the reticulations. Holoventral shield (876 $\mu \times$ 192 μ) with the usual sternal and metasternal setae and three pairs of pores in the sternal region, and the usual three anal setae. Numerous accessory setae are distributed on the genito-ventral region

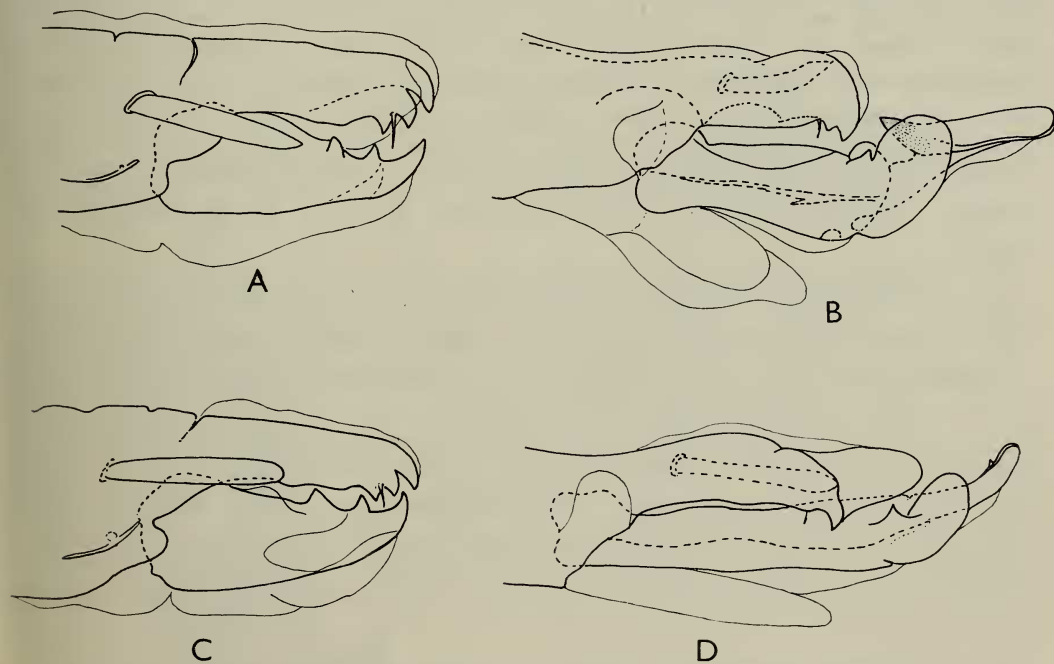


FIG. 57. A-B. *Haemogamasus horridus* Michael; chelicera of female (A) and male (B).
C-D. *Haemogamasus arvicolarum* Berlese; chelicera of female (C) and male (D).

and may extend to the level of the metasternals (Text-fig. 56D). Between *st*1, 87 μ ; between *st*1 and *st*3, 123 μ . Paranal setae 90 μ ; postanal seta 80 μ . Peritreme extends approximately to posterior border of coxa II; peritrematal shield fused anteriorly with dorsal shield, posteriorly with podal shield of coxa IV.

Chaetotaxy of legs as in female. Femur II with seta *av*₁ short and stout (Text-fig. 56E). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	186/66	150/87	144/72	180/66
tibia	198/54	144/78	156/60	204/66
tarsus	270/54	192/60	264/54	384/54

HABITAT: Found on moles, voles and field mice and in their nests in Britain and Europe.

Haemogamasus horridus Michael

Haemogamasus horridus Michael, 1892. *Trans. Linn. Soc. Lond.* 5: 312, figs.

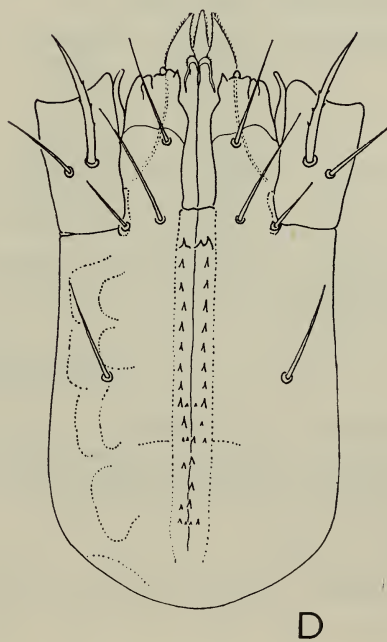
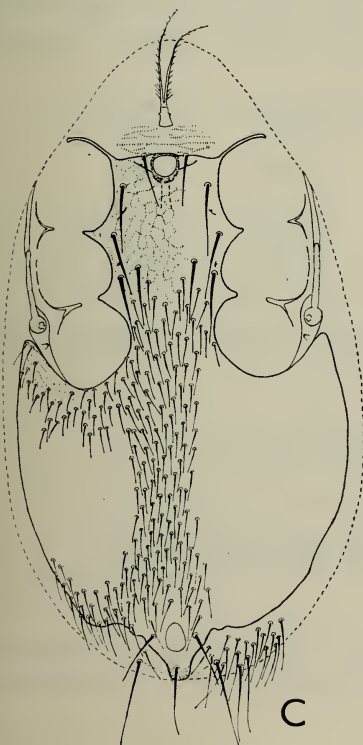
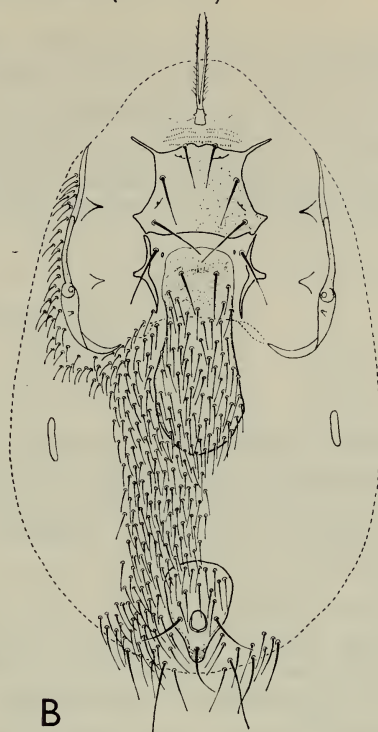
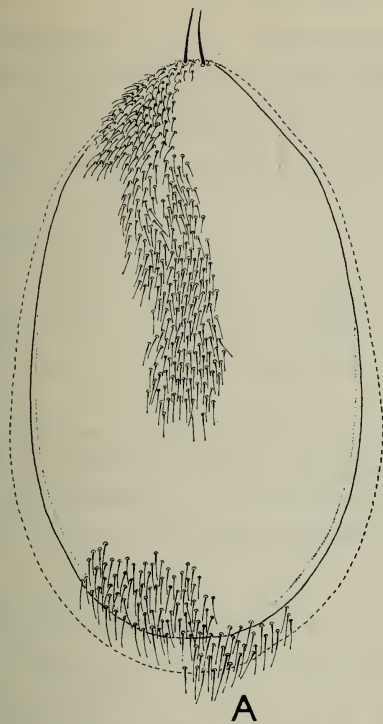
Bregetova, 1956, *Opred. Faune SSSR*. 61: 131, figs.

Female: Chelicera with segment I, 96 μ ; II, 222 μ ; movable digit 75 μ , bidentate; fixed digit bidentate, with terminal hook; pilus dentilis short, setiform; dorsal seta long and stout (Text-fig. 57A). Four pairs of simple gnathosomal setae with *c.s.* about 126 μ apart; *hyp*.2 about 100 μ apart. Deutosternum with 15 transverse rows of denticles (1–5 denticles per row); corniculi broad, membranous, about 45 μ long; internal malae fringed, comprising slender inner and broad, triangular, outer processes (Text-fig. 58D). Tectum capituli has a rounded anterior margin provided with numerous simple or multiple fimbriae. Salivary styli conspicuous. Pedipalp (2–5–6–14) with two-tined apotele; inner trochantal seta barbed.

Dorsal shield (1,536 μ $\times$ 864 μ) with a dense covering of setae for the most part subequal in length, but tending to become longer towards the posterior margin; vertical setae long and stout (Text-fig. 58A). Surface of shield granular and reticulate.

Tritosternum with base 60 μ , laciniae 276 μ ; a small spine present on each side of the base. Presternal area with small spines on the reticulations. Sternal shield (234 μ $\times$ 240 μ) with three pairs of setae and two pairs of pores; metasternal setae free with associated pores. Between *st*1, 80 μ ; between *st*1 and *st*3, 222 μ . Genito-ventral shield with about 70 setae. Anal shield (234 μ $\times$ 138 μ ; maximum width 180 μ) with the usual three anal setae and about 14 accessories. Paranal setae 132 μ , postanal seta 150 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 58B; at least one pair of setae at posterior margin considerably longer than the

FIG. 58. *Haemogamasus horridus* Michael. A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. venter of idiosoma of male; D. venter of gnathosoma of female.



neighbouring setae; some setae with fine, sparse barbs. Peritreme extends to anterior margin of coxa III; anterior tip of peritrematal shield fused with dorsal shield at level of $j1$; posterior part fused with podal shields behind coxae IV.

Chaetotaxy of legs normal except genu IV ($2-\frac{2}{1}, \frac{3}{0}-2$) and tibia IV ($2-\frac{2}{1}, \frac{2}{1}-2$). Leg setae apparently simple; distal margins of most leg segments serrated ventrally. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	252/75	192/108	168/90	222/90
tibia	276/66	192/98	186/90	264/90
tarsus	348/54	288/72	372/72	504/70

Male: Chelicera with segment I, 102 μ ; II, 168 μ ; spermadactyl with a stout retrose spur (Text-fig. 57B). Four pairs of simple gnathosomal setae with c.s. about 102 μ apart, *hyp.2* about 84 μ apart. Deutosternum with 15 transverse rows of denticles (2-3 per row). Corniculi 54 μ long; other gnathosomal features as in female.

Dorsal shield (1,212 $\mu \times 600 \mu$) as in female. Tritosternum with base 48 μ , laciniae 210 μ . Holoventral shield (984 $\mu \times 204 \mu$) with the usual four pairs of sternal and metasternal setae, and also bearing numerous accessory setae which extend anteriorly to the level of *st4*. Between *st1*, 80 μ ; between *st1* and *st3*, 168 μ . Paranal setae 110 μ , postanal seta 135 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 58C. Peritreme extends to anterior margin of coxa III; peritrematal shield fused at its anterior tip with the dorsal shield, and posteriorly with the holoventral shield.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	222/66	156/90	150/75	192/78
tibia	240/57	162/84	168/75	234/78
tarsus	300/54	258/63	330/63	450/60

HABITAT: Associated with moles (*Talpa europaea* Linn.) in Britain, Europe and the U.S.S.R.

Haemogamasus nidi Michael

Haemogamasus nidi Michael, 1892, *Trans. Linn. Soc. Lond.* **5**: 314, figs.

Bregetova, 1956, *Opred. Faune SSSR.* **61**: 134, figs.

Haemogamasus michaeli Oudemans, 1903, *Tijdschr. ned. dierk. Ver.* (2) **8**: 87.

Eulaelaps ambulans (Thorell) Trägårdh, 1910, *Nat. Unter. Sarekgebirges Swed. Lap.* **4** (4): 435, figs. 116-122.

Female: Chelicera with segment I, 90 μ ; II, 147 μ ; movable digit 48 μ , bidentate; fixed digit bidentate; pilus dentilis inflated basally; dorsal seta long and

stout (Text-fig. 59E). Four pairs of barbed gnathosomal setae with *c.s.* about $93\ \mu$ apart, *hyp.2* about $70\ \mu$ apart. Deutosternum with ten transverse rows of denticles (2-5 per row); corniculi $30\ \mu$ long; internal malae with long, pointed inner and short, broad, outer processes, all pilose. Salivary styli conspicuous, extending beyond tips of corniculi. Tectum capituli slender, pointed, fimbriate. Pedipalp (2-5-6-14) with two-tined apotele. Palptrochanter with both setae barbed.

Dorsal shield ($984\ \mu \times 576\ \mu$) with a dense covering of subequal setae (Text-fig. 59A); those on posterior margin slightly longer; setae *j1* longer, stouter and barbed. Many marginal and anterior setae barbed. Surface of shield granular.

Tritosternum with base $48\ \mu$, laciniae $150\ \mu$. Sternal shield ($108\ \mu \times 168\ \mu$) with three pairs of setae and three pairs of pores; metasternal setae free. Between *st1*, $120\ \mu$; between *st1* and *st3*, $120\ \mu$; *st1* barbed. Genito-ventral shield bears numerous setae distributed mostly on posterior two-thirds of shield. Anal shield ($110\ \mu \times 105\ \mu$) with five or six accessories in addition to the usual three anal setae; paranal setae $66\ \mu$; postanal seta $84\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 59B. Peritreme extends to middle of coxa II; anterior tip of peritrematal shield free, but lying very close to dorsal shield; posterior part fused with podal shield of coxa IV.

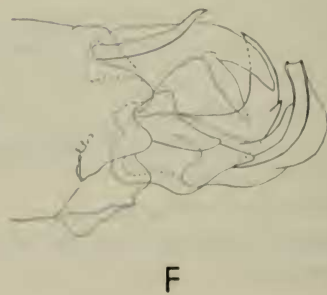
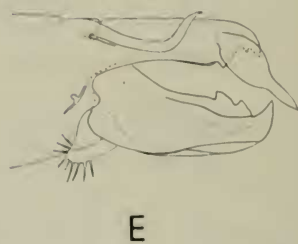
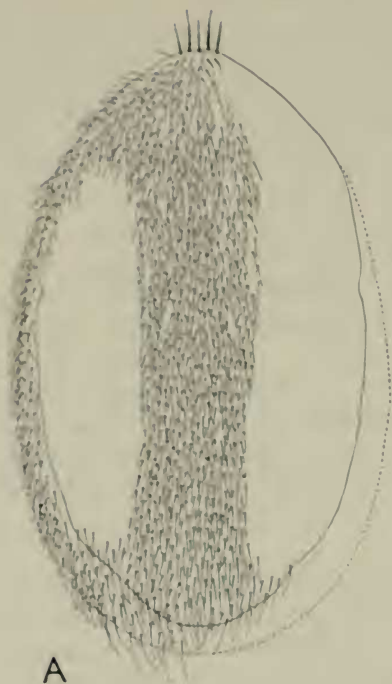
Chaetotaxy of legs differs from normal pattern in that genu IV has two postero-lateral setae and tibia IV has two antero- and two postero-dorsal setae; setae *ad*₁ and *pd*₁ are not visible on tarsi II-IV. Most leg setae barbed. Distal margins of all segments except tarsi serrated. Ambulacrum IV nearly one-and-a-half times as long as ambulacrum III. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	144/54	114/72	90/60	138/57
tibia	156/48	108/66	102/48	150/48
tarsus	216/42	168/48	216/42	315/42

Male: Chelicera with segment I, $75\ \mu$; II, $140\ \mu$. Cheliceral digits and spermadactyl as in Text-fig. 59F. Four pairs of gnathosomal setae with *c.s.* about $84\ \mu$ apart, *hyp.2* about $66\ \mu$ apart. Deutosternum with ten transverse rows of denticles (2-7 per row). Internal malae, salivary styli, tectum and pedipalps as in female.

Dorsal shield ($840\ \mu \times 480\ \mu$) as in female. Tritosternum with base $40\ \mu$, laciniae $120\ \mu$, presternal area as in female. Holoventral shield ($624\ \mu \times 150\ \mu$) with the usual sternal and metasternal setae, and with numerous accessory setae distributed over almost entire shield and extending anteriorly to between *st2* and *st3* (Text-fig. 59C). Between *st1*, $90\ \mu$; between *st1* and *st3*, $110\ \mu$; *st1* barbed. Par- and post-anal setae subequal, about $60\ \mu$ long. Peritreme extends to middle of coxa II; anterior tip of peritrematal shield fused with dorsal shield, posterior tip fused with podal shield of coxa IV.

Chaetotaxy and ornamentation of legs as in female. Stout setae present on femur II (*av*), genu II (*av*), tibia II (*av*) and tarsus II (*av*₂ and *mv*). Length/width (in μ) of leg segments:



	I	II	III	IV
genu	132/48	108/66	96/48	132/48
tibia	138/42	108/60	96/48	144/45
tarsus	192/36	144/42	186/36	282/36

HABITAT : Found in Britain, Europe and the U.S.S.R. chiefly on the bodies and in the nests of a variety of rodents. Also recorded from insectivores, small carnivores and birds.

Haemogamasus pontiger (Berlese)

Laelaps (Eulaelaps) pontiger Berlese, 1904, *Redia* **1** : 260.

Bregetova, 1956, *Opred. Faune SSSR*. **61** : 129, figs.

Groschäftella pontiger: Samsinak, 1957, *Cslka. parasitol.* **4** : 270, figs. 1-2.

Haemogamasus oudemansi Hirst, 1914, *Bull. ent. Res.* **5** : 122, pls. 14-16.

Keegan, 1951, *Proc. U.S. nat. Mus.* **101** : 240, figs. 48-49.

Eulaelaps mawsoni Womersley, 1937, *Austral. Antarctic Exped. 1911-1914 : Scientific Rep. ser. C. Zool. & Bot.* **10** : 19, pl. 12, figs. 4-7.

Female : Chelicera with segment I, 102 μ ; II, 162 μ ; movable digit 63 μ , bidentate ; fixed digit bidentate, pilus dentilis setiform, dorsal seta long and stout (Text-fig. 60c). Four pairs of gnathosomal setae with c.s. about 87 μ apart, *hyp.2* about 66 μ apart ; *hyp.1* simple, *hyp.2-3* and c.s. barbed. Deutosternum with 14 transverse rows of denticles (2-6 per row) ; corniculi 50 μ long ; internal malae as in male (Text-fig. 60g). Tectum capituli slender, pointed, fimbriate. Salivary styli conspicuous. Pedipalp (2-5-6-14) with three-tined apotele (Text-fig. 60f) ; both trochantal setae barbed.

Dorsal shield (840 μ $\times$ 495 μ) with numerous setae distributed as in Text-fig. 60a. Setae *j1* considerably stouter than the others, with fine barbs ; some of the other anterior and antero-lateral setae also barbed. Surface of shield granular, with sculpturing on the podonotal and reticulations on the opisthonotal part.

Tritosternum with base serrated, 50 μ long ; laciniae 126 μ . Presternal area with small spines on the reticulations. Sternal shield (42 μ $\times$ 160 μ) deeply concave posteriorly, with three pairs of setae and three pairs of pores ; metasternal setae free. Between *st1*, 117 μ ; between *st1* and *st3*, 123 μ ; *st1* barbed. Genito-ventral shield (300 μ $\times$ 114 μ) enlarged posteriorly, with maximum width 246 μ ; bearing a pair of genital setae and about 16 accessories on the posterior part of the shield. Anal shield (99 μ $\times$ 111 μ) with two small anterior protuberances ; paranal setae 60 μ ; postanal seta 78 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 60b. Peritreme extends a little beyond posterior border of coxa II ; peritrematal shield free anteriorly, fused posteriorly with podal shield of coxa IV ; pore in posterior part with thickened rim.

FIG. 59. *Haemogamasus nidi* Michael. A. Dorsum of idiosoma of female ; B. venter of idiosoma of female ; C. venter of idiosoma of male ; D. deutosternum of female ; E. chelicera of female ; F. chelicera of male.

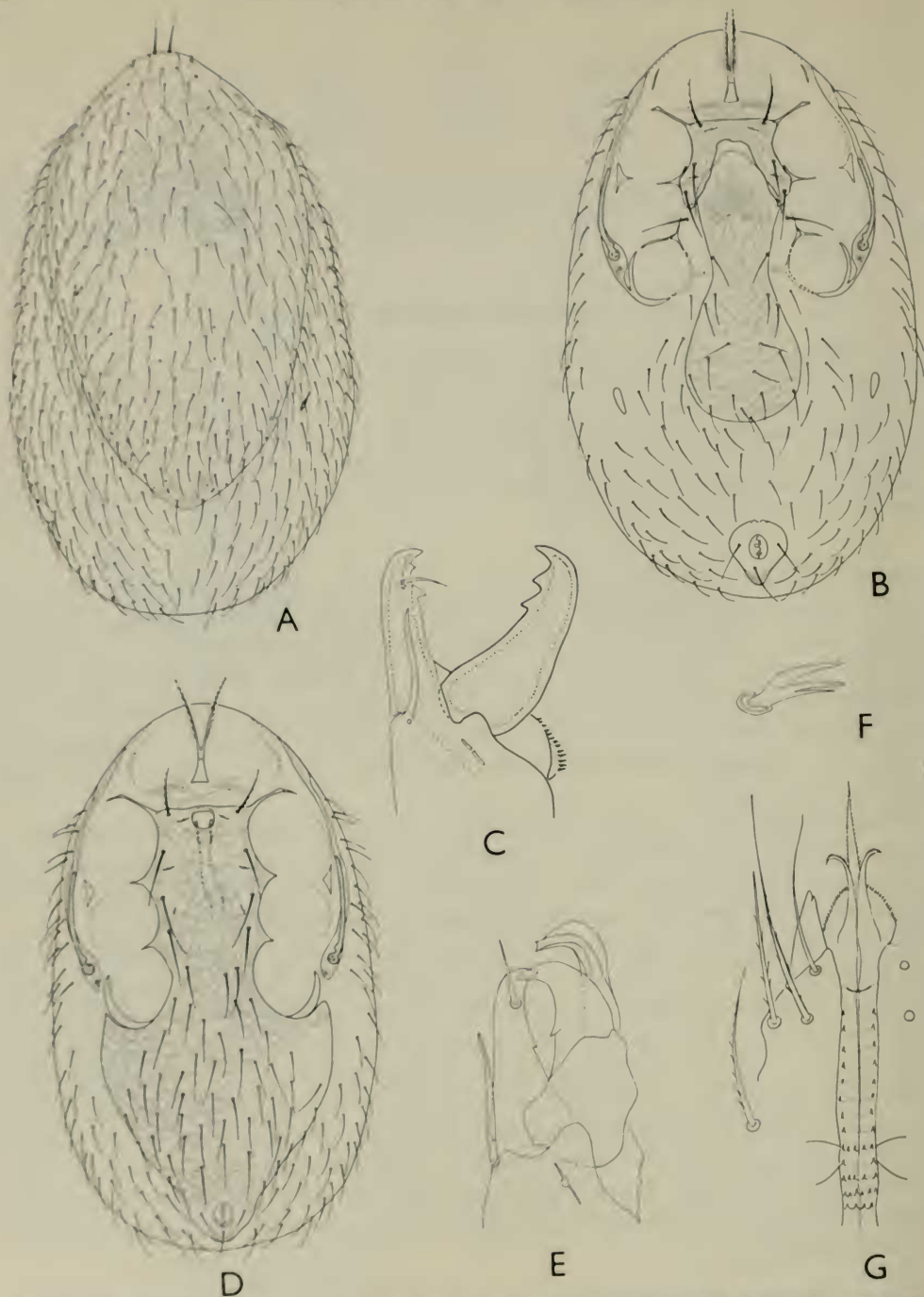


FIG 60. *Haemogamavus pontiger* (Berlese). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. chelicera of female; D. venter of idiosoma of male; E. chelicera of male; F. apotele of pedipalp; G. venter of deutosternum and hypostome of male.

Chaetotaxy of legs differs from normal pattern in that genu IV has two postero-lateral setae and tibia IV has two antero- and two postero-dorsal setae. Setae ad_1 and pd_1 at the extremities of tarsi II–IV are extremely minute and inconspicuous. Tarsus IV with seta pd_2 very long, three-fifths the length of the tarsus. Most leg setae barbed except terminal ones on tarsi. Distal margins of some segments faintly serrated. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	150/45	108/57	90/50	138/48
tibia	162/40	117/54	105/45	150/42
tarsus	246/36	192/40	210/36	300/36

Male : Chelicera with segment I, 70 μ ; II, 126 μ ; movable digit unidentate, 45 μ long (54 μ with spermadactyl) ; fixed digit unidentate ; dorsal seta long and stout ; pilus dentilis setiform (Text-fig. 60E). Four pairs of gnathosomal setae as in female with *c.s.* about 72 μ apart, *hyp.2* about 54 μ apart. Deutosternum with 13 transverse rows of denticles ; corniculi 45 μ long ; internal malae as in Text-fig. 60G. Tectum capituli, salivary styli and pedipalps as in female.

Dorsal shield (660 $\mu \times$ 384 μ) as in female. Tritosternum with base 40 μ , laciniae 102 μ . Presternal area as in female. Holoventral shield (552 $\mu \times$ 126 μ) with four pairs of setae and three pairs of pores in the sternal region, numerous setae distributed over the genito-ventral region (Text-fig. 60D). Between *st1*, 90 μ ; between *st1* and *st3*, 110 μ ; *st1* barbed. Paranal setae 36 μ ; postanal seta 48 μ . Peritreme extends a little beyond posterior margin of coxa II ; peritrematal shield free anteriorly and posteriorly, although anterior tip lies very close to dorsal shield.

Chaetotaxy of legs as in female ; short, stout, blade-like setae on femur III (*v*) and genu III (*pv*). Length/width (in μ) of leg segments :

	I	II	III	IV
genu	130/40	102/51	90/44	126/42
tibia	138/36	102/48	100/40	138/40
tarsus	222/36	156/36	180/33	270/33

HABITAT : A cosmopolitan, facultative parasite recorded from rodents, a mole (*Talpa europaea* Linn.) and a bat ; also free-living in a variety of habitats including barley, sugar, wheat and rice straw, rice hulls and flax tow.

Genus *EULAE LAP S* Berlese

Eulaelaps Berlese, 1903, *Zool. Anz.* **27** : 13.

Hemilaelaps Hull, 1918, *Trans. nat. Hist. Soc. Northumb.* **4** : 61 (*lapsus* for *Eulaelaps*).

Rhinolaelaps Fonseca, 1960, *Acarologia* **2** : 17.

Type : *Gamasus stabularis* Koch, 1836.

Medium to strongly sclerotized mites up to 1,000 μ in length. Chelicerae chelate-dentate, movable digit bidentate in the female, unidentate in the male. Pilus dentilis

relatively long and simple. Dorsal seta and fissures normal. Spermadactyl short, grooved. Arthrodial processes present at base of movable digit in the female. Capitular and hypostomal setae normal. Deutosternum with ten or more transverse rows of denticles, four to seven denticles per row. Corniculi horn-like, internal malae elongate, fringed. Pedipalpal chaetotaxy normal, apotele two-tined. Palp-trochanter with unique sensory organ ventrally. Tectum capituli with anterior and lateral margins deeply denticulate.

Dorsum of idiosoma densely hypertrichous except for region of dorsal hexagon (j5, z5, j6) in some species. Dorsal setae simple or minutely pilose.

Tritosternum normal with lateral margins of basal region denticulate. No distinct pre-endopodal shields. Sternal shield in the female with three pairs of setae and two pairs of pores. Genito-ventral shield large with numerous setae. Anal shield free with normal three setae. Opisthogastric integument hypertrichous. Metapodal shields in the female very large and usually sub-triangular in outline. Peritrematal shields free in the female. Male with holovertral shield; peritrematal shields free or fused with the shield. Podal shields weakly developed posterior to coxae IV.

Segmental chaetotaxy of legs normal except genu IV ($2-\frac{2}{1}$, $\frac{3}{0}-2$). Coxa II with a small anterior spine. Ambulacra with claws sometimes strongly reduced on leg I.

KEY TO FEMALES

- 1 Genito-ventral shield of female with lateral incisions posterior to the genital setae, lateral margins angular, bearing 47-52 opisthogastric setae; no setae on cuticle between genito-ventral and anal shields (Text-fig. 61F). Tarsus II with some spine-like setae (Text-fig. 61C) *E. stabularis* Koch (p. 260)
- Genito-ventral shield without lateral incisions, lateral margins rounded, bearing about 26 opisthogastric setae; setae present on cuticle between genito-ventral and anal shield (Text-fig. 62A). Tarsus II with some stout, spur-like setae (Text-fig. 62E) *E. novus* Vitzthum (p. 263)

KEY TO MALES

- 1 Tarsus II with setiform and spiniform setae; femur II without sclerotized protuberance ventrally *E. stabularis* Koch (p. 262)
- Tarsus II with setiform and stout, spur-like setae; femur II with conspicuous protuberance ventrally distal to fissure. *E. novus* Vitzthum (p. 265)

Eulaelaps stabularis (Koch)⁶

Gamasus stabularis Koch, 1836, *Deutschl. C.M.A.* fasc. 27, no. 1.

Eulaelaps stabularis: Vitzthum, 1927, *Jen. Z. Naturwiss.* **62**: 162.

Brugotova, 1956, *Opred. Faune SSSR* **61**: 100, figs.

Laelaps oribatoides Michael, 1892, *Trans. Linn. Soc. Lond. Zool.* **5**: 315, figs.

Eulaelaps arcualis (Koch) Trägårdh, 1912, *Arch. zool. exp. gen.* **48**: 577, figs. 90-93.

Eulaelaps oudemansi Turk, 1945, *Parasitology* **36**: 137.

⁶ According to Johnston (1959) *Laelaps pedalis* Banks, 1909 and *L. propheticus* Banks, 1909 are also synonyms of *E. stabularis*.

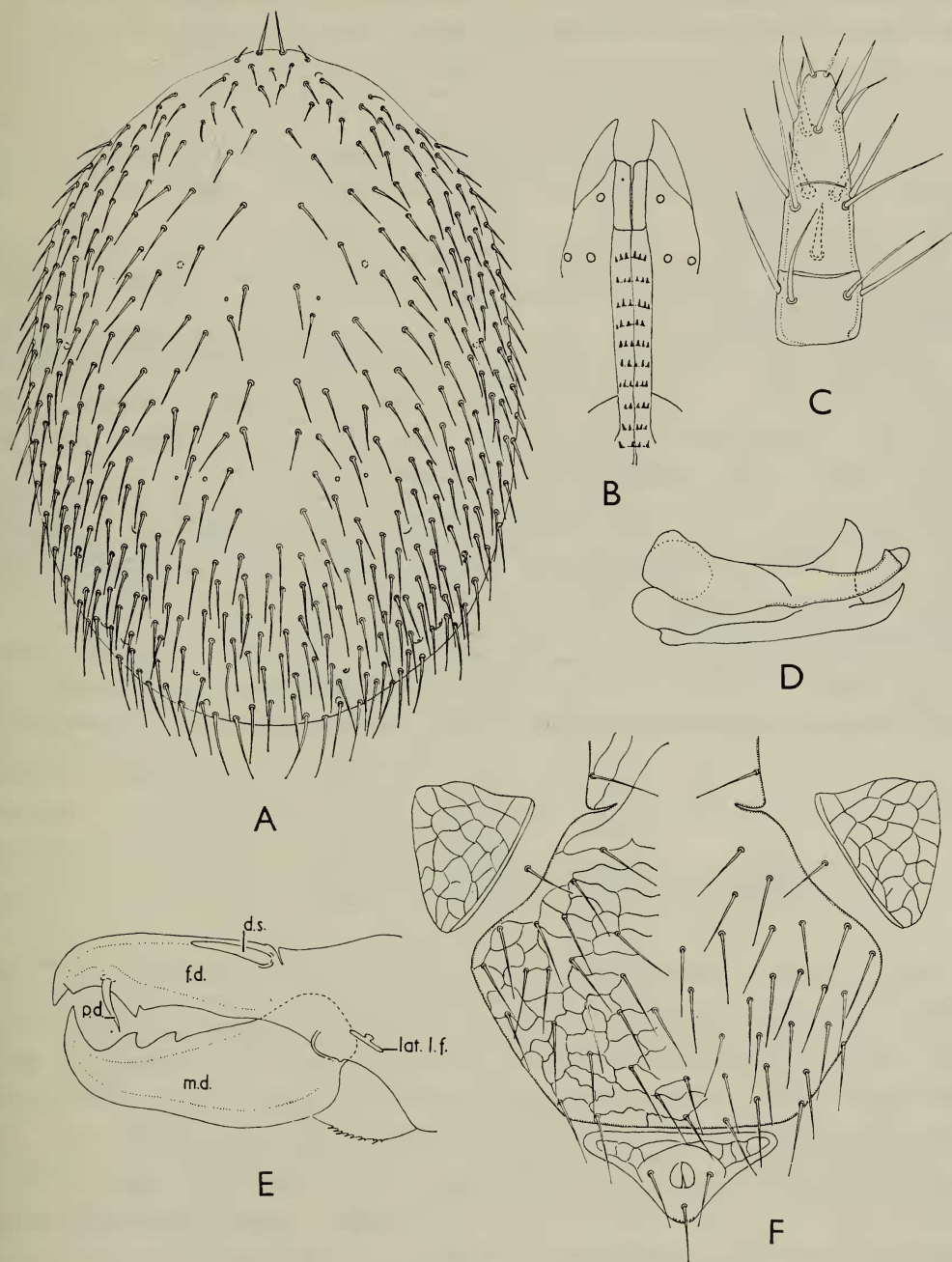


FIG. 61. *Eulaelaps stabularis* (Koch). A. Dorsum of idiosoma of female; B. deutosternum of female; C. tarsus II of female; D. movable digit of chelicera of male; E. chelicera of female; F. opisthogastric region of female.

Female: Chelicera with segment I, 90 μ ; II, 180 μ ; movable digit 75 μ , bidentate; fixed digit tridentate, pilus dentilis short, setiform; dorsal seta stout (Text-fig. 61E). Four pairs of gnathosomal setae with c.s. about 93 μ apart, *hyp.2* about 66 μ apart. Deutosternum (Text-fig. 61B) with ten transverse rows of denticles (4-6 per row); corniculi 60 μ long; internal malae elongate, fringed. Tectum capituli with anterior and lateral margins deeply denticulate. Salivary styli conspicuous, reaching tips of corniculi. Pedipalp (2-5-6-14) with two-tined apotele; palptrochanter with sensory organ ventrally.

Dorsal shield (960 $\mu \times$ 612 μ) shows marked hypertrichy; setae simple, mostly subequal, shorter towards anterior margin (Text-fig. 61A). Surface of shield granular and reticulate.

Tritosternum with base 45 μ , laciniae 160 μ ; presternal area well sclerotized. Sternal shield (156 $\mu \times$ 186 μ) with three pairs of setae and two pairs of pores; metasternal setae free with associated pores. Between *st1*, 96 μ ; between *st1* and *st3*, 138 μ . Genito-ventral shield (408 $\mu \times$ 180 μ) with lateral incisions behind the genital setae; widely expanded behind coxae IV with maximum width 456 μ ; bearing a pair of genital setae and about 47-52 opisthogastric setae (Text-fig. 61F). Anal shield (78 $\mu \times$ 114 μ) with maximum width at anterior margin 222 μ ; paranal setae 63 μ , postanal seta 78-84 μ long. Metapodal shields very large, subtriangular. Peritreme extends to middle of coxa I; anterior tip of peritrematal shield fused with dorsal shield at level of seta *z1*, posterior part free.

Chaetotaxy of legs differs from normal pattern in having two postero-lateral setae on genu IV ($2-\frac{2}{1}, \frac{3}{0}-2$). Tarsus II with some spine-like setae (Text-fig. 61C). Some leg segments with distal margins serrate. Length/width (in μ) of leg segments

	I	II	III	IV
genu	138/60	120/78	96/60	132/54
tibia	150/48	114/72	96/54	138/54
tarsus	228/42	156/54	180/48	270/48

Male: Chelicera with segment I, 48 μ ; II, 130 μ ; movable digit 63 μ , with a large, subterminal, tooth-like projection (Text-fig. 61D); spermadactyl slightly surpasses tip of movable digit; fixed digit edentate, pilus dentilis short, setiform. Four pairs of gnathosomal setae with c.s. about 54 μ apart, *hyp.2* about 50 μ apart. Deutosternum with nine transverse rows of denticles (4-8 per row); corniculi 50 μ long. Internal malae, tectum, salivary styli and pedipalps as in female.

Dorsal shield (582 $\mu \times$ 348 μ) as in female. Tritosternum with base 30 μ , laciniae 108 μ . Holoventral shield (468 $\mu \times$ 126 μ) granular and reticulate; with four pairs of setae and three pairs of pores in the sternal region; a pair of genitals and 36-43 opisthogastric setae in the genito-ventral region. Between *st1*, 66 μ ; between *st1* and *st3*, 102 μ . Paranal setae 48 μ , postanal seta 60 μ long. Peritreme extends to anterior margin of coxa II; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Chaetotaxy of legs as in female. Femur II with seta v_2 relatively stout, tapering. Setae av_2 and mv on tarsus II, seta av on genu and tibia II, stout basally, tapering to fine points. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	96/39	75/48	60/36	78/30
tibia	100/36	72/45	57/36	84/30
tarsus	150/30	96/36	105/30	140/27

HABITAT : Found in Britain and Europe on the bodies and in the nests of rodents and insectivores and in the nests of the Wheatear, *Oenanthe oenanthe* Linn. and the Sandmartin, *Riparia riparia* (Linn.).

Eulaelaps novus Vitzthum

Eulaelaps novus Vitzthum, 1925, *Jen. Z. Naturw.* **62** : 165, fig.

Samsinak, 1960, *Acta Soc. ent. Cech.* **57** : 276, figs.

Eulaelaps kolpakovae Bregetova, 1950, *Parazit. Sb.* **12** : 13, fig. (**syn. nov.**).

Female : Chelicera with segment I, 84 μ ; II, 186 μ ; movable digit 70 μ , bidentate ; fixed digit as in Text-fig. 62c ; pilus dentilis and dorsal seta short, setiform. Four pairs of gnathosomal setae with c.s. about 72 μ apart, *hyp.* 2 about 66 μ apart. Deutosternum with eleven transverse rows of denticles (5–7 per row) ; corniculi 50 μ long ; internal malae elongate, fringed (Text-fig. 62f). Tectum capituli with anterior and lateral margins deeply denticulate (Text-fig. 62b). Salivary styli conspicuous, reaching tips of corniculi. Pedipalp (2–5–6–14) with two-tined apotele ; palptrochanter with sensory organ ventrally.

Dorsal shield (936 μ $\times$ 588 μ) hypertrichous, surface of shield granular and reticulate. Setae simple, mostly subequal, slightly longer in the opisthonotal region.

Tritosternum with base 63 μ , laciniae 150 μ . Sternal shield (120 μ $\times$ 168 μ) with three pairs of setae and two pairs of pores ; metasternal setae free with associated pores on medial margin of setal bases. Between $st1$, 102 μ ; between $st1$ and $st3$, 132 μ . Genito-ventral shield (324 μ $\times$ 144 μ) expanded posteriorly with maximum width 300 μ ; bearing a pair of genital and about 26 opisthogastric setae. Anal shield (100 μ $\times$ 132 μ) with paranal setae 75 μ , postanal seta 50 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 62A ; metapodal shields large, subtriangular. Peritreme extends to anterior margin of coxa II ; anterior part of peritrematal shield fused with dorsal shield, posterior part free, its pore apparently situated at the bottom of a wide cavity.

Chaetotaxy of legs differs from the normal pattern in that genu IV has two posterolateral setae ($2-\frac{2}{1}$, $\frac{3}{0}-2$) and tarsi II–IV lack setae ad_1 and pd_1 . Tarsus II (Text-fig. 62E) bears several stout, spur-like setae (av_1 , al_1 , pl_1 , av_2 , pv_2 , mv). Ambulacrum I without claws (Text-fig. 62G). Length/width (in μ) of leg segments :

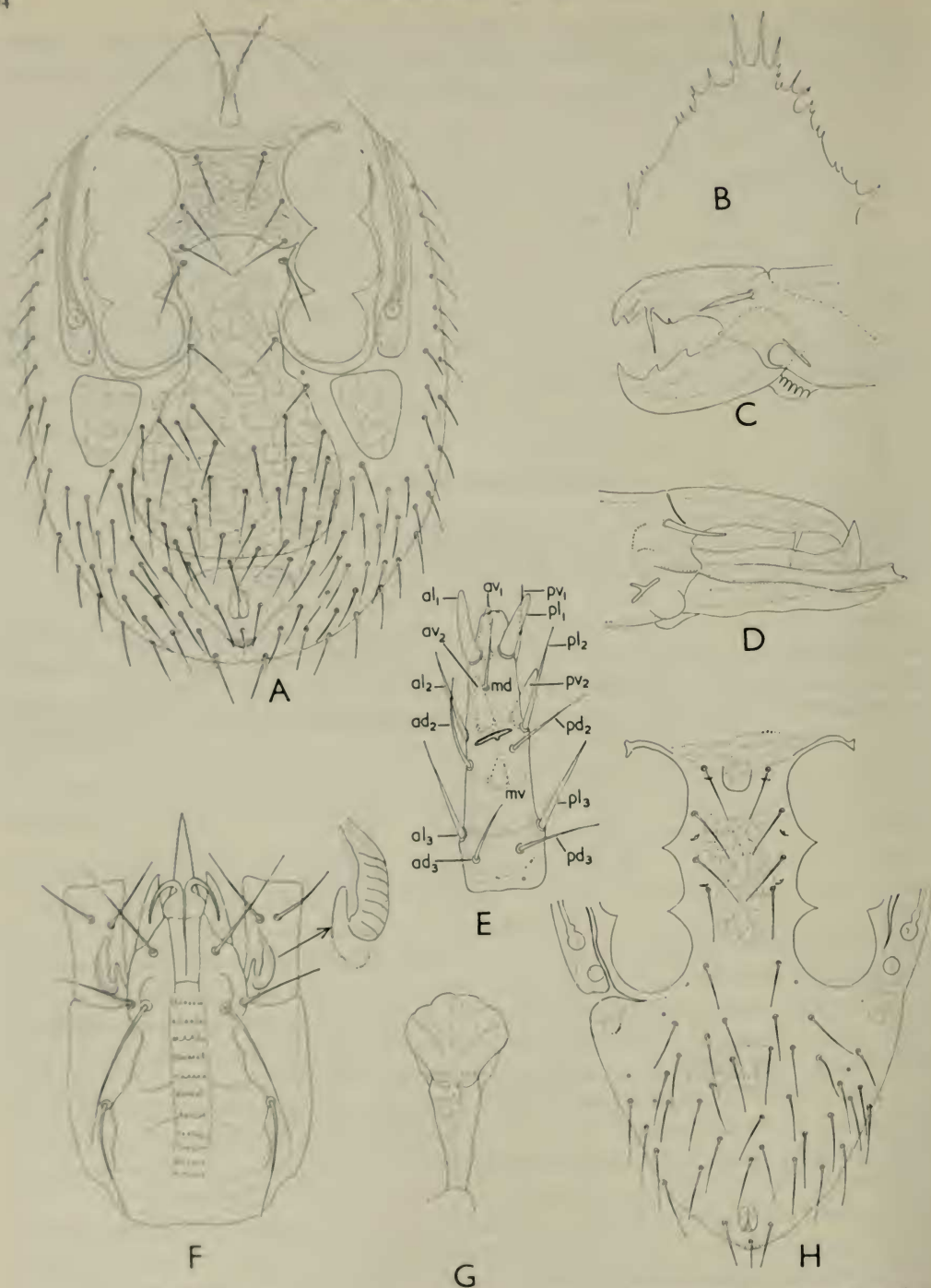


FIG. 62. *Eulaelaps novus* Vitzthum. A. Venter of idiosoma of female; B. tectum capituli of female; C. chelicera of female; D. chelicera of male; E. tarsus II of female; F. venter of gnathosoma of female; G. ambulacrum of leg I of female; H. holoventral shield of male.

	I	II	III	IV
genu	126/54	126/72	90/54	132/52
tibia	138/50	108/72	96/54	144/48
tarsus	204/42	150/52	162/45	276/42

Male : Chelicera with segment I, 75 μ ; II, 162 μ ; movable digit 66 μ (81 μ with spermadactyl) ; both digits edentate ; pilus dentilis and dorsal seta as in female (Text-fig. 62D). Four pairs of gnathosomal setae with c.s. about 75 μ apart, *hyp*.2 apart 60 μ apart. Deutosternum with 12 transverse rows of denticles (6–10 per row) ; corniculi 36 μ long. Internal malae, tectum, salivary styli and pedipalps as in female.

Dorsal shield (732 μ $\times$ 492 μ) as in female. Tritosternum with base 42 μ , laciniae 132 μ . Holoventral shield (576 μ $\times$ 135 μ) as in Text-fig. 62H. Between *st*1, 84 μ ; between *st*1 and *st*3, 110 μ . Paranal setae 54 μ ; postanal seta 40 μ . Peritreme extends to middle of coxa II ; anterior part of peritrematal shield fused with dorsal shield ; posterior part free on one side of the only available male, on the other side fused with podal elements of coxa IV and with holoventral shield.

Chaetotaxy of legs as in female. Femur II with large ventral protuberance distal to fissure. Genu and tibia II with setae *av* stout basally. Tarsus II with several stout, blunt setae (*av*₁, *al*₁, *pl*₁, *av*₂, *pv*₂) ; seta *mv* stout basally with sharp, tapering point. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	114/48	114/70	84/50	120/48
tibia	120/45	102/60	87/48	126/45
tarsus	186/42	126/40	126/40	234/38

HABITAT : Found in Britain and Europe in the nests of *Riparia riparia* (Linn.). Recorded by Bregetova from the nests of a variety of rodents in the U.S.S.R.

Subfamily **PSEUDOLAE LAPINAE** nov.

Adults : Chelicera of both sexes chelate-dentate ; pilus dentilis short, setiform ; dorsal seta and arthrodial processes present ; fissures normal. Male chelicera with spermadactyl grooved, free distally. Chaetotaxy of venter of gnathosoma normal. Pedipalps with five free segments ; chaetotaxy of trochanter to tibia (2–5–6–14) ; apotele two-tined. Deutosternum with seven transverse rows of denticles. Corniculi horn-like, internal malae inflated basally. Tectum captuli trispinate.

Dorsal sclerotization in both sexes comprises an entire shield ; primary chaetotaxy reduced, consisting of 24 pairs of setae.

Tritosternum bipartite, laciniae pilose. Pre-endopodal shields present. Sternal shield in the female with three pairs of setae and two pairs of pores ; metasternal setae on small platelets. Genito-ventral shield inflated, bearing the genital and two pairs of opisthogastric setae. Anal shield with normal chaetotaxy, no euanal setae.

Opisthogastric cuticle sparsely setose. Metapodal shields small, ovoid. Peritrematal shields fused with large podal shields posterior to coxae IV; peritremes extend beyond coxae I. Male with holovenral shield fused with peritrematal shields; genital orifice presternal.

All legs six-segmented, with ambulacra and claws. Deviations from normal chaetotaxy occur on genu and tibia I ($2-\frac{3}{1}$, $\frac{3}{1}-2$), genu II ($2-\frac{3}{0}$, $\frac{2}{1}-2$) and genu III ($2-\frac{2}{1}$, $\frac{2}{0}-1$). Coxa II with rounded anterior protuberance.

Immature stages not known.

A single genus.

Genus *PSEUDOLAE LAP S* Berlese

Hoplolaelaps Berlese, 1910, *Redia* 6: 259 (non *Hoplolaelaps* Berlese, 1903).

Pseudolaelaps Berlese, 1916, *Redia* 12: 30.

Type: *Laelaps* (*Hoplolaelaps*) *doderoi* Berlese, 1910.

With the characters of the subfamily.

Pseudolaelaps doderoi (Berlese)

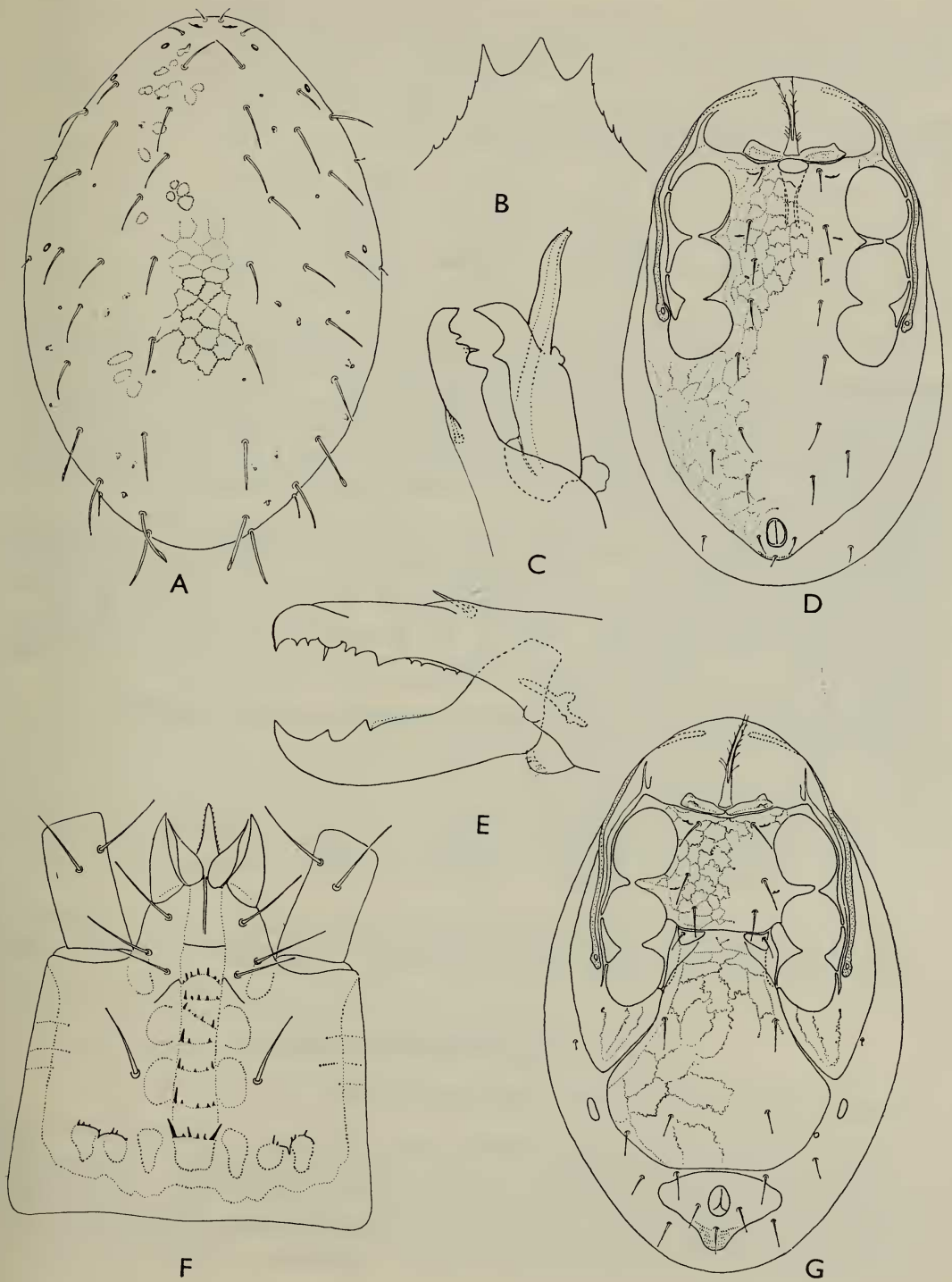
Laelaps (*Hoplolaelaps*) *doderoi* Berlese, 1910, *Redia* 6: 259.

Female: Chelicera with segment I, $54\ \mu$; II, $130\ \mu$; movable digit $50\ \mu$, bidentate; fixed digit with about nine teeth, pilus dentilis short, setiform; dorsal seta nearly half-way towards apex of digit (Text-fig. 63E). Four pairs of gnathosomal setae with c.s. about $42\ \mu$ apart, *hyp.* 2 about $36\ \mu$ apart. Deutosternum with seven transverse rows of denticles (3 to 7 denticles per row); a row of small denticles postero-lateral to the capitular setae; corniculi $33\ \mu$ long, horn-like; internal malae broad basally, tapering to fine points (Text-fig. 63F). Tectum capituli trispinate, lateral margins denticulate (Text-fig. 63B). Pedipalps (2-5-6-14) with two-tined apotele.

Dorsal shield ($474\ \mu \times 318\ \mu$) with 24 pairs of setae distributed as in Text-fig. 63A, some posterior setae paddle-shaped. Surface of shield reticulate.

Tritosternum with base $27\ \mu$, laciniae $70\ \mu$. Sternal shield ($100\ \mu \times 110\ \mu$) with three pairs of setae and two pairs of pores; metasternal setae on small shields, associated pores not visible. Between *st*1, $48\ \mu$; between *st*1 and *st*3, $78\ \mu$. Genito-ventral shield ($135\ \mu \times 100\ \mu$) greatly expanded posteriorly, with a pair of genital and two pairs of opisthogastric setae; greatest width of shield about $204\ \mu$. Anal shield ($48\ \mu \times 108\ \mu$) with paranal setae $18\ \mu$, postanal seta $15\ \mu$ long. Chaetotaxy

FIG. 63. *Pseudolaelaps doderoi* Berlese. A. Dorsum of idiosoma of female; B. tectum capituli of female; C. chelicera of male, internal view; D. venter of idiosoma of male; E. chelicera of female, internal view; F. venter of gnathosoma of female; G. venter of idiosoma of female.



and sclerotization of opisthogaster as in Text-fig. 63G. Peritreme extends beyond lateral margin of gnathosoma; peritrematal shield fused with large metapodal shield.

Chaetotaxy of legs differs from normal pattern on genu and tibia I ($2-\frac{3}{1}$, $\frac{3}{1}-2$), genu II ($2-\frac{3}{0}$, $\frac{2}{1}-2$), and genu III ($2-\frac{2}{1}$, $\frac{2}{0}-1$). Coxa II has a rounded anterior protuberance. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	66/24	54/30	42/24	60/27
tibia	63/18	54/30	45/27	72/24
tarsus	108/15	117/24	108/24	170/20

Male: Chelicera with segment I, 42 μ ; II, 100 μ ; movable digit 42 μ (54 μ with spermadactyl), unidentate; fixed digit with two teeth and a minute, setiform, pilus dentilis on a small, tooth-like projection (Text-fig. 63C). Four pairs of gnathosomal setae with c.s. about 36 μ apart; *hyp*.2 about 30 μ apart. Deutosternum with six transverse rows of denticles (two to several per row); a row of small denticles postero-lateral to setae c.s. Corniculi 30 μ long; internal malae, tectum and pedipalps as in female.

Dorsal shield (354 $\mu \times$ 246 μ) with 24 pairs of setae as in female. Tritosternum with base 12 μ , laciniae 57 μ . Holoventral shield (282 $\mu \times$ 90 μ) with four pairs of setae and three pairs of pores in the sternal region, four pairs of setae in the genito-ventral region (Text-fig. 63D). Between *st*1, 40 μ ; between *st*1 and *st*3, 66 μ . Paranal setae 15 μ , postanal seta 12 μ long. Peritreme as in female, peritrematal shield fused with holoventral shield.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	54/20	48/27	40/24	50/20
tibia	57/18	45/27	40/24	60/20
tarsus	90/15	90/20	90/20	144/18

HABITAT: Recorded in Britain from the soil of a grassy bank, London, and from an arable field on clay/chalk, Winchester, Hampshire. Originally found in soil in Italy.

Subfamily MYONYSSINAE Bregetova

Myonyssinae Bregetova, 1956, *Opred. Faune SSSR*. 61: 52.

Adults: Chelicerae essentially edentate, fixed digit long and slender in both sexes and in the female it may have a small dorsally directed tooth. Spermadactyl relatively short, grooved, and entirely fused with the movable digit. Pilus dentilis and dorsal seta apparently absent, fissures inconspicuous, arthrodial processes absent. Chaetotaxy of venter of gnathosoma normal; pedipalps with five free segments

and a two-tined apotele, chaetotaxy normal (2-5-6-14). Deutosternum with 9-12 denticles arranged in a single file. Corniculi horn-like, relatively weakly sclerotized; internal malae long, simple. Salivary styli massive. Tectum capituli elongate, tapering distally and with a smooth margin.

Dorsal shield entire in both sexes; in the female typically with 38 pairs of setae comprising 21 pairs of podonotals (22 lacking) and 17 pairs of opisthonotals (px_2 and px_3 present). Sometimes normal complement decreased (*M. montanus*) by the absence of px_2 , px_3 and S_3 on the opisthonotal region. Dorsal shield in the males of two main types, one in which the chaetotaxy resembles that of the female (*M. montanus* group), and the other in which the female complement is increased by the incorporation of certain of the r and R setae on the lateral margins of the shield (*M. gigas* group). Sexual dimorphism is evident in the second type, by the extreme length of certain of the setae on the posterior region of the shield.

Tritosternum bipartite, base lacking hyaline denticulate border. Sternal shield well-sclerotized, reticulate, slightly wider than long and bearing three pairs of setae and two pairs of pores. Genito-ventral shield large, flask-shaped, with from 4-22 setae excluding the genitals. Anal shield with normal three setae, rarely with an additional unpaired accessory seta, and considerably wider than long. Metapodals present. Opisthogastric cuticle with varying degrees of hypertrichy. Peritrematal shields free posteriorly. Male with holoventral shield free from peritrematal shields and with hypertrichy of the ventral region.

Chaetotaxy of legs normal. Coxa II usually with prominent anterior spine. All ambulacra with well-developed claws.

Larva and Protonymph: Apparently unknown.

Deutonymph: Active feeding instar. Gnathosoma with characteristics of female. Dorsal shield with lateral incisions; chaetotaxy of the dorsum as in the female, but fewer setae situated on the dorsal shield. Tritosternum bipartite, pilose. Sternito-genital shield with sternal setae 1-3; metasternals and genitals flanking the shield. Anal shield similar in shape to that of female; chaetotaxy of opisthogaster as in adult. Peritremes shorter than in the adult. Leg chaetotaxy normal.

Genus *MYONYSSUS* Tiraboschi

Myonyssus Tiraboschi, 1904, *Arch. Parasit.* 8: 337.

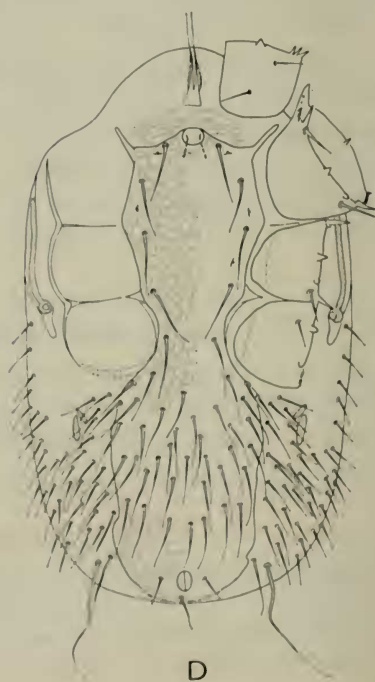
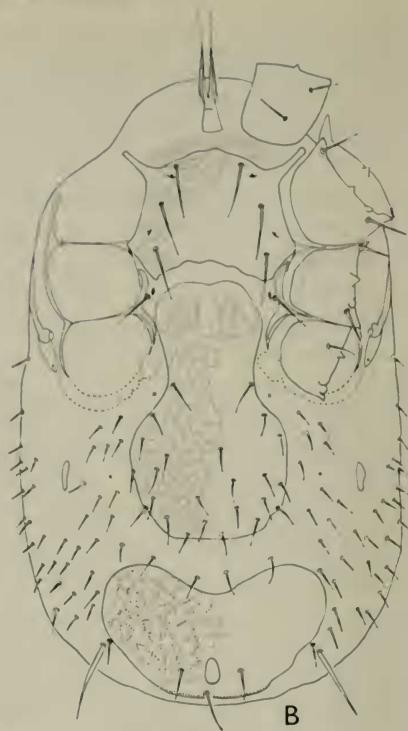
Tetragonyssus Ewing, 1923, *Proc. U.S. nat. Mus.* 62 (art. 13): 6.

Type: *Myonyssus decumani* Tiraboschi, 1904.

The genus has the characters of the subfamily as diagnosed above.

KEY TO FEMALES

- Genito-ventral shield with less than 12 setae; anal shield about $1\frac{1}{2}$ times as broad as long *M. decumani* Tiraboschi (p. 271)
 Genito-ventral shield with about 20 setae (Text-fig. 64B); anal shield about twice as broad as long *M. gigas* (Oudemans) (p. 271)



Myonyssus decumani Tiraboschi

Myonyssus decumani Tiraboschi, 1904, *Arch. parasit.* **8**: 337; Hirst, 1916, *J. zool. Res.* **1**: 64, figs.

We have not examined specimens of this species which is adequately described and figured by Hirst (1916).

HABITAT: The only British records of the species are from a house mouse (*Mus musculus* Linn.) at Ollaberry, Shetland Islands (Hirst, 1916).

Myonyssus gigas (Oudemans)

Liponyssus gigas Oudemans, 1912, *Ent. Ber. Amst.* **3**: 231.

Myonyssus gigas: Bregetova, 1956, *Opred. Faune SSSR.* **61**: 123, figs. 243, 251.

Female: Chelicera with segment I, 48 μ ; II 189 μ ; movable digit 57 μ , edentate; fixed digit unidentate (Text-fig. 65A and B); pilus dentilis absent. Four pairs of gnathosomal setae with *c.s.* about 72 μ apart, *hyp.2* about 54 μ apart. Deutosternum with eleven denticles arranged in a single file; corniculi 45 μ long, weakly sclerotized; internal malae elongate (Text-fig. 65C). Salivary styli conspicuous, extending well beyond tips of corniculi. Tectum capituli triangular with smooth margin (Text-fig. 65D). Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (1,140 $\mu \times$ 636 μ) with 38 pairs of setae distributed as in Text-fig. 64A; seta 22 is absent. Setae Z5 and S5 considerably longer than the other setae and very stout and blade-like. Surface of shield reticulate with a granular pattern posteriorly; no hypertrichy.

Tritosternum with base 70 μ , laciniae 170 μ . Sternal shield (210 $\mu \times$ 252 μ) with three pairs of setae and two pairs of pores; metasternal setae free with associated pores; between *st1*, 120 μ ; between *st1* and *st3*, 174 μ . Genital shield (282 $\mu \times$ 160 μ) flask-shaped with one pair of genital setae and about 22 opisthogastric setae which are not strictly symmetrical in their arrangement (Text-fig. 64B). Anal shield (186 $\mu \times$ 294 μ) with deeply concave anterior margin and maximum width 408 μ . Paranal setae 60 μ , postanal seta 66 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 64B. Peritreme extends to posterior third of coxa II; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Legs with normal chaetotaxy. Coxae II-IV are provided with spurs, as shown in Text-fig. 64B. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	144/96	144/102	120/90	150/84
tibia	135/84	108/96	108/84	150/84
tarsus	174/70	144/72	168/70	216/72

FIG. 64. *Myonyssus gigas* (Oudemans). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. dorsum of idiosoma of male; D. venter of idiosoma of male.

Male: Chelicera with segment I, $60\ \mu$; II, $180\ \mu$; movable digit $80\ \mu$, both digits edentate (Text-fig. 65E). Four pairs of gnathosomal setae with c.s. about $72\ \mu$ apart, hyp.2 about $57\ \mu$ apart. Deutosternum, internal malae, salivary styli, tectum and pedipalps as in female. Corniculi $54\ \mu$ long, slender, weakly sclerotized.

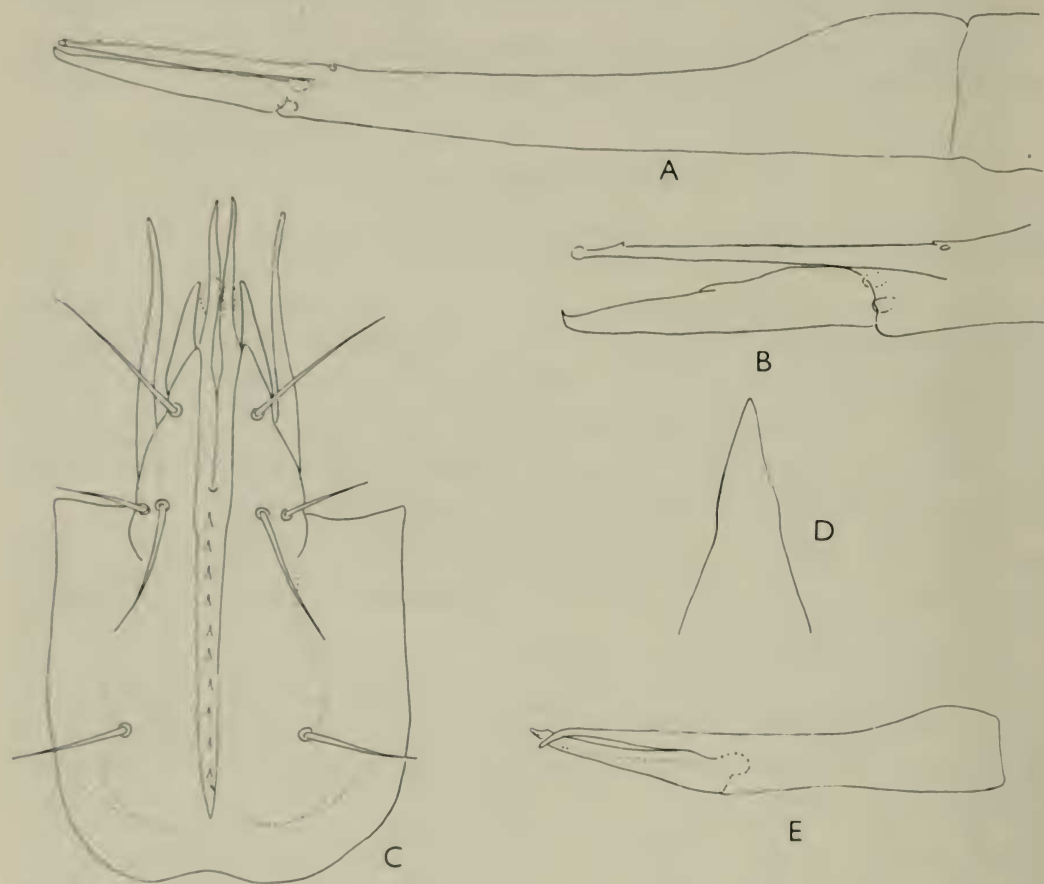


FIG. 65. *Myonyssus gigas* (Oudemans). A-B. Chelicera of female; C. venter of gnathosoma of female; D. tectum capituli of female; E. chelicera of male.

Dorsal shield ($1,188\ \mu \times 684\ \mu$) with 21 pairs of setae in the podonotal region, as in the female, whereas the opisthonotal region bears 22 pairs of setae, five marginal pairs being included on the shield (Text-fig. 64c). The setae are relatively longer than in the female and some, particularly the Z and S series and J4-5, are sinuous.

Tritosternum with base $36\ \mu$, laciniae $174\ \mu$. Holoventral shield ($984\ \mu \times 270\ \mu$) with four pairs of setae and three pairs of pores in the sternal region and numerous setae in the genito-ventral region. Between st1, $114\ \mu$; between st1 and st3, $198\ \mu$. Paranal setae $60\ \mu$, postanal seta $78\ \mu$. Chaetotaxy and sclerotization of opistho-

gaster as in Text-fig. 64D. Peritreme extends to posterior third of coxa II ; anterior part of peritrematal shield fused with dorsal shield, posterior part free.

Legs with normal chaetotaxy. Coxae I-IV provided with spurs, as shown in Text-fig. 64D. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	168/108	168/132	144/114	192/117
tibia	162/96	138/120	126/102	180/110
tarsus	192/84	174/84	180/78	264/87

HABITAT : Found on moles (*Talpa europaea* Linn.) and in their nests, and on field mice [*Apodemus flavicollis* (Melchior) and *Apodemus sylvaticus* (Linn.)] in Britain and Europe.

Subfamily MELITTIPHINAE nov.

Adults : Chelicerae in the female chelate, fixed digit essentially edentate, movable digit weakly bidentate. Chelicerae of male strongly modified ; fixed digit reduced ; movable digit fused with long, slender, grooved spermadactyl. Pilus dentilis present in female ; dorsal seta and fissures normal ; arthrodial processes present, at least in female. Chaetotaxy of venter of gnathosoma and pedipalps normal. Apotele two-tined. Deutosternum with about eight denticles in a single file. Corniculi slender, horn-like ; internal malae long, bipartite anteriorly. Tectum capituli with smooth, rounded, anterior margin.

Dorsum of idiosoma entirely covered by a single shield, hypertrichy obscuring the primary chaetotaxy. Certain marginal setae subspinose.

Tritosternum bipartite, normal. Presternal area moderately sclerotized, with a median keel-like ridge. Sternal shield in female with three pairs of setae and two pairs of pores. Genital shield flask-shaped with genital setae only. Anal shield ovoid, with aciculated portion bent dorsally, resulting in posterior margin of shield appearing concave. Anus situated in posterior third of shield ; a posteriorly directed spur present immediately anterior to the anus. Opisthogastric cuticle hypertrichous. Peritrematal shields free posteriorly. Male with a sternito-genital and a ventro-anal shield.

Chaetotaxy of legs normal except tibia III ($2-\frac{1}{1}, \frac{2}{1}-2$) and genu IV ($2-\frac{2}{1}, \frac{3}{1}-1$). Coxa II with complex anterior spine (Text-fig. 66c). All ambulacra with a pair of claws.

The genus *Melittiphis* was previously placed in the family Eviphididae, on the basis of Vitzthum's (1930) description of the tectum capituli, namely : " Epistom dem *Iphis*-Typus entsprechend eine langgezogene Spitze, beiderseits und dorsal fein gezähneht ". This description refers to the labrum and not to the tectum (see Text-fig. 66B).

Immature stages not known.

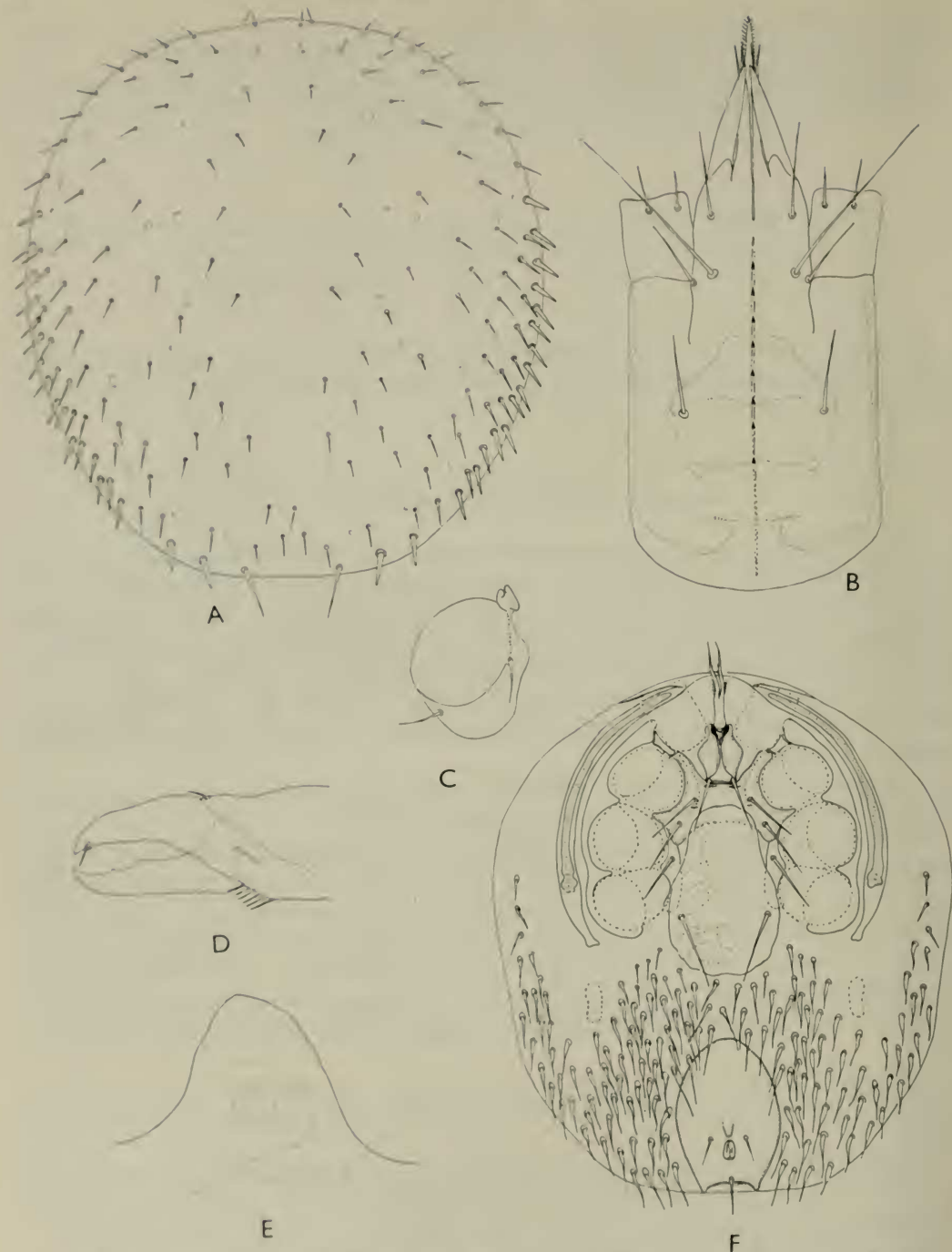


FIG. 66. *Melittiphis alvearius* (Berlese), female; dorsum of idiosoma (A); venter of gnathosoma (B); coxa II (C); chelicera (D); tectum capituli (E); venter of idiosoma (F).

Genus *MELITTIPHIS* Berlese*Melittiphis* Berlese, 1918, *Redia* 13: 117.Type: *Laelaps (Iphis) alvearius* Berlese, 1896.

The genus has the characters of the subfamily as diagnosed above.

Melittiphis alvearius (Berlese)*Iphis alvearius* Berlese, 1896, *Atti Soc. Veneto-Trent.* (2) 2: 318.

Female: Chelicera with segment I, 48 μ ; II, 115 μ ; movable digit 45 μ , weakly bidentate; fixed digit edentate, pilus dentilis and dorsal seta short, setiform (Text-fig. 66D). Four pairs of gnathosomal setae with distance between c.s. slightly exceeding distance between *hyp.2*. Deutosternum with eight denticles arranged in a single file; corniculi 36 μ long, converging; internal malae elongate, bipartite anteriorly (Text-fig. 66B). Tectum capituli with anterior margin smooth (Text-fig. 66E). Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (780 $\mu \times$ 660 μ) shows marked hypertrichy; marginal setae relatively stout and spine-like (Text-fig. 66A). Surface of shield reticulate.

Tritosternum with laciniae about three times as long as the base. Sternal shield (75 $\mu \times$ 80 μ) with three pairs of setae and two pairs of pores; metasternal setae situated over the endopodal shields. Between *st1*, 30 μ ; between *st1* and *st3*, 78 μ . Genital shield (90 $\mu \times$ 147 μ) with genital setae only. Anal shield (204 $\mu \times$ 138 μ) with paranal setae 40 μ , postanal seta 48 μ . Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 66F. Peritreme extends nearly to anterior margin of coxa I; anterior part of peritrematal shield fused with dorsal shield at level of seta *z2*, posterior part free.

Chaetotaxy of legs differs from normal pattern in that tibia III has two postero-lateral setae (2— $\frac{1}{1}$, $\frac{2}{1}$ —2), genu IV has two ventral setae (2— $\frac{2}{1}$, $\frac{3}{1}$ —1), tarsi II–IV lack setae *ad*₁ and *pd*₁. Stout spine-like setae are present on femur II (*ad*₁, *pd*₁, *pl*₁ and *v*₃); trochanter III (*al*); femur III (distal dorsal); genu III (*ad*₁); trochanter IV (*al*); femur IV (distal dorsal); genu IV (*ad*₁₋₂). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	72/45	84/70	63/57	75/54
tibia	72/36	60/54	54/48	66/48
tarsus	138/36	135/42	144/42	168/42

Male: Certain details of the morphology of the male, given in the subfamilial diagnosis, have been obtained from a specimen in the Berlese collection, Florence.

HABITAT: Found in bee-hives in Britain and Europe.

Subfamily **HIRSTIONYSSINAE** nov.

Adults : Chelicerae in female chelate-edentate, movable digit rarely bidentate or weakly dentate ; fixed digit with hyaline process which may be produced distally into a slender lobe (*Patrinyssus*). Male with relatively short, grooved spermadactyl usually completely fused with the movable digit ; fixed digit edentate. Pilus dentilis apparently absent, dorsal seta reduced to microseta or absent, fissures present, arthrodial processes reduced or absent. Chaetotaxy of venter of gnathosoma normal. Pedipalpal chaetotaxy normal or femur unidifferent, genu unidifferent, or tibia unidifferent ; apotele simple (*Patrinyssus*) or two-tined. Palptrochanter rarely with ventral keel produced posteriorly into a spur (*Trichosuroclaps*). Deutosternum with five to 18 transverse rows of denticles, transverse rows comprising one to four denticles. Hypostome elongate, internal malae simple, often long ; corniculi membranous, rarely with horn-like apex. Tectum capituli tongue-like, with anterior margin smooth or fimbriated.

Dorsum with entire shield in both sexes, bearing 22–27 pairs of setae in the female, never holotrichous ; setae *z*1 rarely present, *J* series showing hypotrichy, *J*5 present or absent ; opisthonotal region of shield with less than 15 pairs of setae in the female. Sexual dimorphism apparent in the relative lengths of the lateral and marginal setae, those of the male being considerably longer than in the female. Dorsal setae simple.

Tritosternum normal, bipartite, laciniae smooth or pilose, without hyaline denticulate margins. Sternal shield in female with three pairs of setae and two pairs of pores ; metasternals free. Genital shield tongue-shaped, normally bearing only the genital setae. Anal shield normal, opisthogastric cuticle with a variable number of setae which may be affected by sexual dimorphism. Metapodal shields weakly developed or absent. Peritrematal shields free or fused posteriorly with the podal shields. Stigmatal atrium normal or greatly enlarged, peritremes often reduced. Podal shields poorly developed posterior to coxae IV. Male with holovenral shield not fused with peritrematal shields ; rarely with division or weaker sclerotized region between the ventral and anal portions of the shield. Genital orifice presternal.

Chaetotaxy of legs normal (*Hirstionyssus*) or with deficiencies in the chaetotaxy of genua and tibiae III and IV. Anterior spine of coxa II well developed or absent (*Patrinyssus*), that of *Echinonyssus* greatly enlarged and hook-like. One or more of the coxae with a distinct, non-setigerous spur or spurs (excluding anterior spine of coxa II). Certain coxal setae and ventral setae of tibiae and genua may be hypertrophied and form retrograde spurs. Ambulacra with well-developed claws. Male with thumb-like ventral spur on femur II in some *Echinonyssus*.

Immature stages : The larval and protonymphal stages have been described only for *Hirstionyssus* (Bregetova, 1956). The larva is apparently non-feeding and has weakly developed chelicerae with minute digits. On the other hand, the protonymph is probably a feeding stage although the form of the chelicerae is not shown in detail by Bregetova. It lacks distinct dorsal and ventral sclerotization. All known deutonymphs are feeding stages with the general characteristics of the female except

for the intercoxal region which has a sternito-genital shield bearing four pairs of setae; the genital setae flank the shield in the region of coxae IV.

This subfamily is represented in the British fauna by the genus *Hirstionyssus*.

Genus *HIRSTIONYSSUS* Fonseca

Hirstionyssus Fonseca, 1948, *Proc. zool. Soc. Lond.* **118**: 266.

Type: *Hirstionyssus talpae* Zemskaya, 1955 (= *Hirstionyssus arcuatus* (Koch) Fonseca, 1948).

Medium sclerotized mites ranging from 450 μ to 950 μ in length. Chelicerae chelate-edentate in both sexes; fixed digit in the female with membranous sheath. Movable digit in male completely fused with the deeply grooved spermadactyl. Pilus dentilis apparently absent; dorsal seta reduced to microseta or absent; fissures present. Arthrodial processes at base of movable digit reduced or absent. Chaetotaxy of venter of gnathosoma normal; pedipalpal chaetotaxy normal (2-5-6-14), or palptibia unidifferent (2-5-6-13) or bidifferent (2-5-6-12), apotele two-tined. Palptrochanter without ventral keel. Deutosternum with 11 to 18 rows of denticles, each row comprising one to four denticles. Internal malae simple, variable in length; corniculi membranous, never horn-like. Salivary styli strong. Tectum capituli elongate, tongue-shaped, with anterior margin smooth or fimbriated.

Dorsum of idiosoma with entire shield bearing 23 to 27 pairs of setae; $\alpha 1$ never present. Chaetotaxy of opisthonotal region may show intraspecific variation. Unpaired accessory setae never present.

Tritosternum normal, bipartite. Sternal shield in female with three pairs of setae and two pairs of pores. Genital shield tongue-shaped, bearing one pair of genital setae only. Pear-shaped anal shield with normal chaetotaxy, paranal setae approximately level with or behind anterior margin of anus. Opisthogastric cuticle with a variable number of setae which may be affected by sexual dimorphism. Peritrematal shields free or fused posteriorly with the podal shields. Metapodal shields weakly developed or absent. Male with holovertral shield not fused with peritrematal shields, and bearing eight pairs of setae excluding the anals. Podal shields poorly developed posterior to coxae IV.

Chaetotaxy of legs normal. At least one of the coxae provided with non-setigerous spurs, apart from the anterior spine of coxa II. All ambulacra with a pair of well-developed claws.

As in many other genera of obligatory ectoparasitic dermanyssid mites, there is considerable confusion in the literature concerning the nomenclature and systematic position of certain of the "older" species. This is particularly evident in the genus *Hirstionyssus* and concerns, in the present study, the species *Hirstionyssus arcuatus* (Koch) and *musculi* (Johnston). The confusion has arisen largely from Oudemans' concept of the species *Dermanyssus arcuatus* Koch, *Acarus musculi* Schrank and *Dermanyssus musculi* Koch.

The type host of *D. arcuatus* is the chiropteran "*Vespertilio noctula*", but the original description and illustration of the species are inadequate for its specific

identity. Berlese (1889), following Canestrini 1885, attributed *arcuatus* [*Leiognathus arcuatus* (K.) Can.] to a species of dermanyssine mite commonly found on vespertilionid bats (particularly "*V. noctula*") and his figures and description leave one in no doubt that he considered *arcuatus* to be a member of the genus *Steatonyssus* (probably *S. periblepharus* Kolenati) in its present concept. However, Oudemans (1913), without reference to Berlese or Canestrini, considered *Dermanyssus arcuatus* Koch, which he transferred to the genus *Liponyssus*, to be conspecific with a dermanyssine mite associated with *Talpa* and gave a comprehensive description, with figures, of this mole mite. Unfortunately subsequent workers, excluding Zemskaya and Bregetova in the U.S.S.R., have accepted Oudemans' concept of *arcuatus* and Fonseca (1948)⁷ proposed the genus *Hirstionyssus* to accommodate the type *Hirstionyssus arcuatus* (Koch, 1839) and several congeneric species. *Hirstionyssus arcuatus* (Koch) Fonseca, 1948, and its congeners are essentially ectoparasites of Insectivora, Carnivora, Lagomorpha and Rodentia; there are no authenticated records of any *Hirstionyssus* species from Chiroptera. Thus, there can be no doubt that *H. arcuatus* sensu Fonseca 1948 and Oudemans 1913, is neither conspecific nor congeneric with *Dermanyssus arcuatus* Koch, 1839 and, in our opinion, Zemskaya (see Bregetova, 1956) was correct in proposing the name *Hirstionyssus talpae* for *Liponyssus arcuatus* sensu Oudemans, 1913 [= *Hirstionyssus arcuatus* (Koch) Fonseca]. *Hirstionyssus talpae* Zemskaya, 1955, becomes the type of the genus *Hirstionyssus* Fonseca.

Strandtmann & Wharton (1958) have continued to use *Hirstionyssus arcuatus* (Koch) sensu Oudemans 1913 and their synonymy of the species and list of hosts demonstrate the utter confusion surrounding this name. The synonyms *Dermanyssus albatus* Koch, 1839, *Dermanyssus noctula* Koch, 1839 (teste Oudemans, 1936) and *Dermanyssus pipistrellae* Gervais, 1841, are all bat mites and probably belong in the Macronyssinae whilst the host list contains several species of Chiroptera, *Putorius erminea*, as well as *Talpa europaea* and many Rodentia. There is little point in attempting to conserve *Hirstionyssus arcuatus* under these conditions. We strongly advise for the sake of nomenclatural stability the acceptance of *Hirstionyssus talpae* for *Hirstionyssus arcuatus* Oudemans non Koch, 1839, and the removal of *Dermanyssus arcuatus*, *albatus* (based on a protonymph), *noctulae* and *pipistrellae* from *Hirstionyssus* to the subfamily Macronyssinae where they can remain as species incertae sedis. Reference to Chiroptera as hosts of *Hirstionyssus* should in future be excluded unless, of course, the record can be authenticated.

Till & Evans (1964) have already commented on Oudemans' concepts of *Dermanyssus musculi* Koch 1839 and have shown that at one time or another he considered the species to be congeneric with *Steatonyssus*, *Macronyssus* and *Ornithonyssus*. His final opinion appears to be expressed in the "*Kritisch Historisch Übersicht der Acarologie*" (1936) where he considered *D. musculi* to be synonymous with *Acarus musculi* Schrank 1803 and referred both to the genus *Steatonyssus*. Both Schrank and Koch recorded their species from the house mouse (*Mus musculus*) and since there have

⁷ Fonseca states: "*Hirstionyssus*, gen. nov., here created to include numerous species related to *Dermanyssus arcuatus* Koch, 1839 (= *Liponyssus arcuatus* auct.) parasites on Chiroptera, Rodentia etc. . . . Genotype *Hirstionyssus arcuatus* (Koch, 1839)".

never been any confirmed records of species of the genus *Steatonyssus* from this host (or from any other rodent for that matter), it seems almost certain that Schrank's and Koch's mites do not belong to this genus. Zemskaya (1955) and Bregetova (1956) who were the first to examine critically the old "*Hirstionyssus arcuatus* complex" showed that the species occurring on *Talpa* was not conspecific with the species parasitizing *Mus*, *Rattus* and *Apodemus*, for which they adopted the name *Hirstionyssus musculi* (Johnston). In our opinion this name cannot be used for this species for the following reasons:

1. Johnston (1849) described his species under the name *Dermanyssus musculi* and indicated that he considered it to be conspecific with *D. musculi* Koch by referring to "*Dermanyssus musculi*, Koch Uebers. Arachnid p. 81 tab. 9 fig. 46" immediately after his Latin diagnosis of the species. If Johnston's species is not conspecific with *D. musculi* Koch, as Zemskaya and Bregetova infer, then they should have used the combination *Hirstionyssus johnstoni* (Oudemans, 1936) [= *Macronyssus johnstoni* Oudemans nom. nov. pro *Dermanyssus musculi* Johnston 1849 non Koch 1836] and not *Hirstionyssus musculi* (Johnston).
2. It is clear from Johnston's description that his species was not a *Hirstionyssus*; for example, its size is stated to be equal to *Gamasus coleoptratorum* (whose nymphs measure about 1,000 μ in length), the body is thickly covered with very short, adpressed, somewhat curved bristles and the "bristles" of the legs are stated to be "setaceous, pointed downwards, longer than the diameter of the joint, barbed with minute spinules on one side". Johnston's mite was probably a species of *Haemogamasus*.

The original descriptions of the colour of the idiosoma of *Acarus musculi* Schrank and its synonym *Dermanyssus musculi* Koch indicate that the species is a haemato-phagous, obligatory ectoparasite. Schrank's "braunroth . . . und das Vorderende weisslicht" and Koch's "Der Vorderleib rein weiss, ein Schieffleck, von den Seiten bis zum Hinterrande reichend dunkelroth, dazwischen ein herzförmiges Fleckchen hellroth" could refer to engorged forms of both *Hirstionyssus* and *Ornithonyssus* in which the general brownish-red colouration of the idiosoma does not extend to the anterior region, the colour pattern being determined by the blood-containing diverticula of the "stomach". The description of the first pair of legs—"Fusspaar etwas länger und schmaler"—by Schrank and the form of these appendages in Koch's illustration of the species excludes the possibility that *A. musculi* is a *Hirstionyssus* and supports our previous suggestion that the species "might possibly be conspecific with *O. bacoti*" (Till and Evans, 1964).

Hirstionyssus musculi (Johnston) Bregetova appears to be conspecific with at least two, possibly three, presently considered valid species of *Hirstionyssus*,⁸ namely, *H. cynomys* (Radford, 1941) from *Cynomys* species, *H. latiscutatus* (de Meillon & Lavoie-

⁸ *Hirstionyssus otomys* (Radford, 1942) also bears a superficial resemblance to this complex but may be readily distinguished by having only 12 setae on the palptibia and the tendency for the third pair of sternal setae to be off the sternal shield. We have recently found this species on *Arvicanthis abyssinicus* from the Congo.

pierre, 1944) from *Rattus rattus* and *H. orcadensis* (Turk, 1946) from *Microtus orcadensis*. We are unable to distinguish morphologically the type specimens of the females of *H. latiscutatus* and *orcadensis* from our material (including specimens presented by Dr. Bregetova) of "*H. musculi*" from *Mus musculus* and *Apodemus sylvaticus*; all occur on murines. *H. cynomys*, of which we have examined only the "type" specimen, is undoubtedly closely related to "*musculi*", but shows differences in the form of setae av_1 and pv_1 on tarsi II and IV; on tarsus II these setae are claw-like but longer and less distinctly curved while on tarsus IV seta av_1 is stout and spine-like and pv_1 is relatively slender and whip-like distally. In view of these slight morphological differences and the systematic position of the host (*Cynomys*: Sciuridae) we are reluctant to assign "*H. musculi* (Johnston) Bregetova" to this taxon and propose using the next available combination, *Hirstionyssus latiscutatus* (de Meillon & Lavoipierre).

KEY TO FEMALES

- 1 Sternal shield rectangular. Podonotal region with setae s_1 and s_2 on integument. Coxae II and III each with one spur (including anterior spur of coxa II). Palptibia with 13 setae ***H. blanchardi*** (Trouessart) (p. 296)
- Sternal shield arched, posterior border markedly concave. Podonotal region with setae s_1 and s_2 on shield. Coxae II and III each with two spurs. Palptibia with 12 to 14 setae 2
- 2 Opisthonotal region of dorsal shield with 10 or more pairs of setae. Palptibia with 14 setae 3
- Opisthonotal region of dorsal shield with eight pairs of setae. Palptibia with 12 or 13 setae 4
- 3 Tarsus II with setae av_1 and pv_1 stout, claw-like; coxa IV with a small spur on its postero-distal margin. Podonotal region of dorsal shield with 16 pairs of setae (r_2 off the shield) ***H. latiscutatus*** (de Meillon & Lavoipierre) (p. 291)
- Tarsus II with setae av_1 and pv_1 simple; coxa IV without spur. Podonotal region of dorsal shield with 17 pairs of setae (r_2 off the shield) ***H. isabellinus*** (Oudemans) (p. 295)
- 4 Podonotal region with 15 pairs of setae on the dorsal shield, s_6 lacking; three pairs of r setae on the cuticle ***H. soricis*** (Turk) (p. 286)
- Podonotal region with 16 pairs of setae on the dorsal shield, s_6 present; four pairs of r setae on the cuticle 5
- 5 Coxa II with anterior seta short, stout and blunt; posterior spur large and pointed. Dorsal shield with seta z_2 at least twice the length of seta s_1 ***H. talpae*** Zenskaya (p. 281)
- Coxa II with anterior seta simple; posterior spur relatively smaller. Dorsal shield with setae z_2 and s_1 subequal in length ***H. oryctolagi*** sp. nov. (p. 286)

KEY TO MALES⁹

- 1 Coxa III with one spur. Palptibia with 13 setae. ***H. blanchardi*** (Trouessart) (p. 298)
- Coxa III with two spurs. Palptibia with 12 or 14 setae 2
- 2 Opisthonotal region of dorsal shield with 10 or more pairs of setae. Palptibia with 14 setae 3
- Opisthonotal region of dorsal shield with eight pairs of setae. Palptibia with 12 setae 4

⁹ Male of *H. oryctolagi* not known.

- 3 Coxa II with anterior spur only. Opisthogastric setae relatively short
H. isabellinus (Oudemans) (p. 296)
- Coxa II with two spurs. Opisthogastric setae extremely long
H. latiscutatus (de Meillon & Lavoipierre) (p. 291)
- 4 Dorsal shield with postero-lateral setae considerably longer than terminal (Z_5) setae; podonotal region of shield with 18 pairs of setae. Anterior seta on coxa II simple
H. talpae Zemsкая (p. 283)
- Dorsal shield with postero-lateral and terminal (Z_5) setae subequal in length; podonotal region of shield with 17 pairs of setae. Anterior seta on coxa II short and stout
H. soricis (Turk) (p. 288)

Hirstionyssus talpae Zemsкая

Liponyssus arcuatus (Koch) Oudemans, 1913, *Arch. Naturgesch. Abt. A* **79** (9) : 68, figs.

Hirstionyssus talpae Zemsкая, 1955, in Bregetova *et al.*, *Opred. Faune SSSR*. **59** : 360, figs.

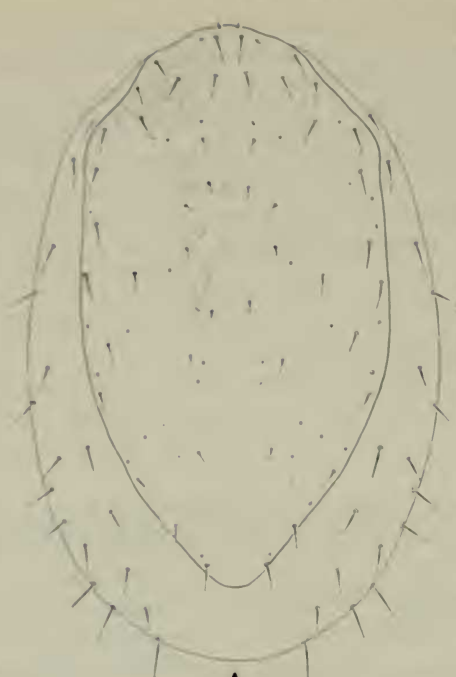
Female: Chelicera with segment I, 50 μ ; II, 93 μ ; movable digit 40 μ ; both digits edentate (Text-fig. 69c). Four pairs of gnathosomal setae with *c.s.* about 48 μ apart; *hyp.2* about 30 μ apart. Deutosternum with 12 rows of denticles (one to four denticles per row). Corniculi membranous, internal malae slender, elongate; salivary styli conspicuous (Text-fig. 68D). Tectum capituli tongue-shaped, anterior margin fimbriate (Text-fig. 69D). Pedipalp (2-5-6-12) with bi-deficient chaetotaxy on palptibia (Text-fig. 69B); apotele two-tined.

Dorsal shield (576 $\mu \times$ 324 μ) with 24 pairs of setae distributed as in Text-fig. 67c; seta *z2* about twice as long as setae *s1* and *s2*. Surface of shield granular, with reticulations anteriorly and laterally. About 13 pairs of setae on the unsclerotized integument, including *r2*, *r3*, *r5* and *r6*; *r4* is lacking.

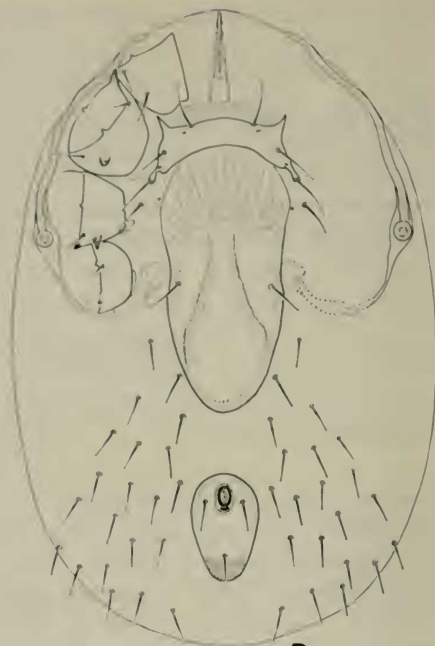
Tritosternum with base 36 μ , laciniae 75 μ . Sternal shield (24 $\mu \times$ 135 μ) arched, strongly concave posteriorly, with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st1*, 68 μ ; between *st1* and *st3*, 80 μ . Surface of shield granular, reticulated in antero-lateral corners. Genital shield (138 $\mu \times$ 114 μ) granular, with one pair of setae. Anal shield (96 $\mu \times$ 78 μ) with par- and post-anal setae subequal in length (27 μ). Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 67D. Peritreme extends about to middle of coxa I; anterior part of peritrematal shield free; posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs normal. Tarsus II with setae *av1* and *pv1* stout and claw-like (Text-fig. 69F), tarsus IV with these setae long and slender (Text-fig. 69G). Anterior seta on coxa II short and stout (Text-fig. 69A). Coxal spur formula (0-2-2-1). Length/width (in μ) of leg segments:

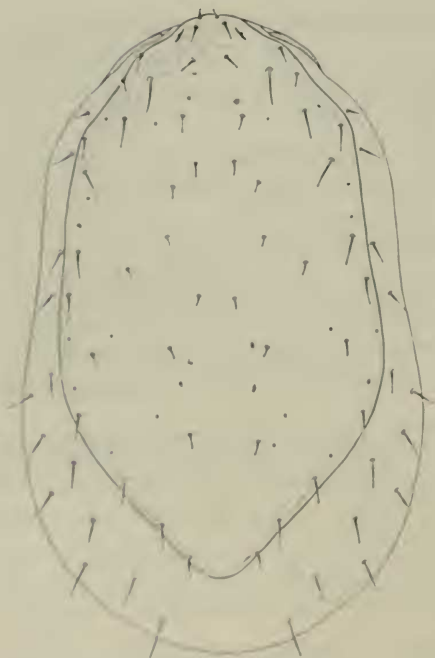
	I	II	III	IV
genu	60/48	60/54	45/42	60/45
tibia	60/45	48/48	42/40	54/42
tarsus	90/36	72/40	72/36	90/36



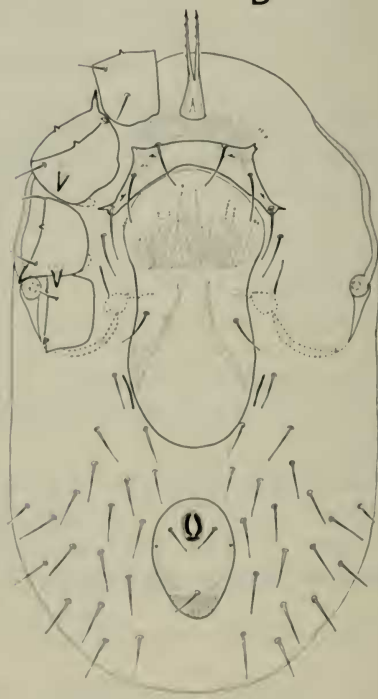
A



B



C



D

Male (large form) : Chelicera with segment I, $45\ \mu$; II, $84\ \mu$; spermadactyl $45\ \mu$ long from base of movable digit (Text-fig. 69E). Four pairs of gnathosomal setae with c.s. about $48\ \mu$ apart, *hyp.2* about $30\ \mu$ apart. Other gnathosomal features as in female.

Dorsal shield ($552\ \mu \times 348\ \mu$) with 26 pairs of setae distributed as in Text-fig. 68A ; *r2* and *r3* situated on the shield. Setae *z2*, *z4*, *s3-s6*, *r3* and postero-lateral setae considerably longer than any of the othersetae. Surface of shield granular, reticulated anteriorly and laterally. Unsclerotized integument of dorsum with five pairs of setae, including *r5* and *r6*, *r4* being absent.

Tritosternum with base $33\ \mu$, laciniae $78\ \mu$. Holoventral shield ($444\ \mu \times 117\ \mu$) with four pairs of setae and three pairs of pores in the sternal region, four pairs of setae in the genito-ventral region. Between *st1*, $50\ \mu$; between *st1* and *st3*, $98\ \mu$. Par- and postanal setae subequal in length ($30\ \mu$). Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 68B. Peritreme extends to middle of coxa I ; fused anteriorly with dorsal shield. Posterior part of peritrematal shield very small and free.

Chaetotaxy of legs normal. Tarsus II with setae *av*₁ and *pv*₁ stout and claw-like. Stout, spine-like setae present on a number of segments : trochanter I (*d*), femur I (*ad*₁, *pd*₁₋₂) ; femur II (*pd*₂) ; genu and tibia II (*pv*) ; femur III (*v* and *al*) ; genu and tibia III (*av*) ; femur IV (*al* and *v*) ; genu and tibia IV (*av*) ; tarsus IV (*av*₁ and *mv*). All the ventral setae on tarsus III and seta *mv* on tarsus II are stout basally, tapering to long fine points. Coxa II with anterior seta relatively longer than in female. Coxal spur formula (0-2-2-1). Length/width (in μ) of leg segments :

	I	II	III	IV
genu	60/48	70/54	57/48	75/57
tibia	60/40	50/50	50/45	70/48
tarsus	84/33	70/38	80/36	105/36

Male (small form) : A small male has been found which closely resembles the large form except in its body measurements and the relative length and thickness of the setae.

Dorsal shield ($468\ \mu \times 258\ \mu$) with chaetotaxy as in large form. Holoventral shield ($372\ \mu \times 114\ \mu$) a little more slender than in large form ; opisthogastric setae relatively shorter (Text-fig. 68C). Between *st1*, $50\ \mu$; between *st1* and *st3*, $78\ \mu$. Par- and postanal setae about $20\ \mu$ long.

Chaetotaxy of legs as in large form, but the stout setae are not as greatly enlarged. The spur on coxa IV is a rather small, rounded process. Length/width (in μ) of leg segments :

FIG. 67. A-B. *Hirstionyssus oryctolagi* sp. nov., female ; dorsum (A) and venter (B) of idiosoma. C-D. *Hirstionyssus talpae* Zenskaya, female ; dorsum (C) and venter (D) of idiosoma.

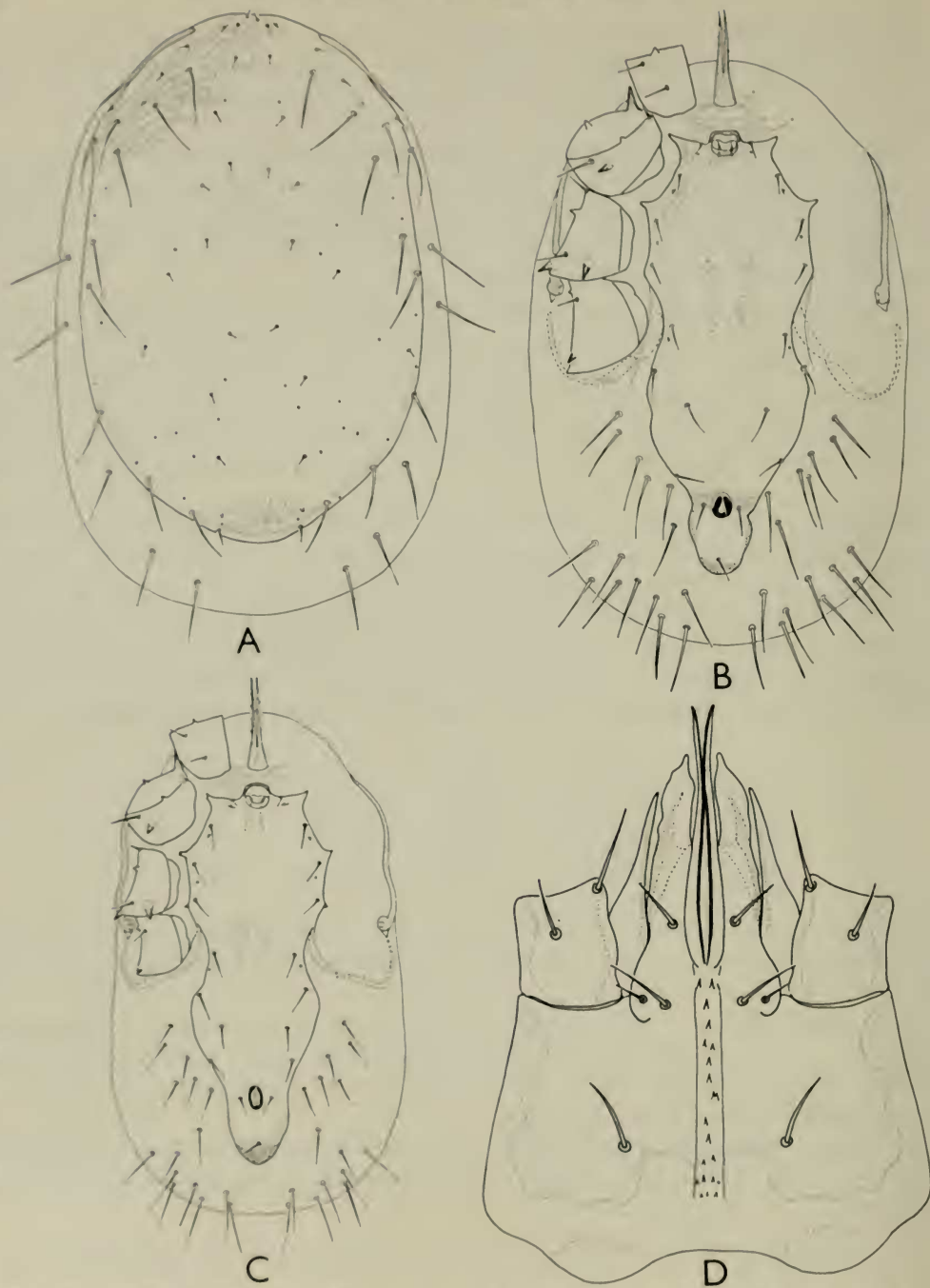


FIG. 68. *Hirationyssus talpae* Zemskaya. A. Dorsum of idiosoma of male; B. venter of idiosoma of male, large form; C. venter of idiosoma of male, small form; D. venter of gnathosoma of female.

	I	II	III	IV
genu	52/42	54/45	40/36	50/40
tibia	50/36	42/42	36/36	48/36
tarsus	75/30	60/33	66/30	78/30

HABITAT: Common in the nests of *Talpa europaea* Linn. in Britain, Europe and the U.S.S.R.

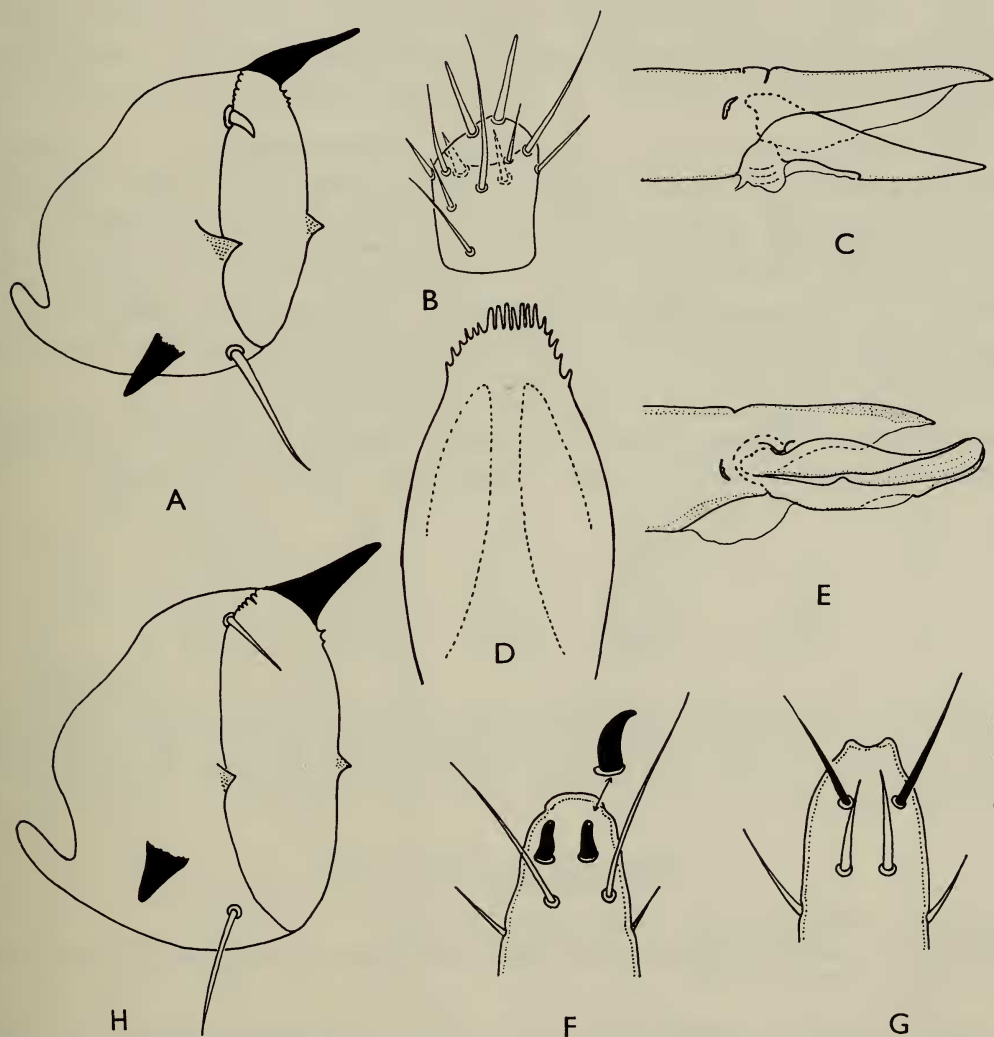


FIG. 69. A-G. *Hirstionyssus talpae* Zemskaya; coxa II of female (A); palptibia of female (B); chelicera of female (C); tectum capituli of female (D); chelicera of male (E); venter of distal third of tarsus II of female (F); venter of distal third of tarsus IV of female (G). H. *Hirstionyssus oryctolagi* sp. nov.; coxa II of female.

Hirstionyssus oryctolagi sp. nov.

Female: Chelicera with segment I, 60 μ ; II, 108 μ ; movable digit 50–54 μ . Four pairs of gnathosomal setae with c.s. about 48 μ apart, *hyp*.2 about 24–33 μ apart. Deutosternum with 14–15 rows of denticles (one to three denticles per row). Corniculi membranous; internal malae slender, elongate; salivary styli conspicuous. Tectum capituli tongue-shaped, anterior margin apparently smooth. Pedipalp (2–5–6–12/13) with uni- or bidentate chaetotaxy on palptibia; apotele two-tined.

Dorsal shield (666–672 μ $\times$ 366 μ) with 24 pairs of setae distributed as in Text-fig. 67A; setae *z*2, *z*4 and the *s* series subequal in length. Surface of shield granular with reticulations near the margin, especially anteriorly and laterally. Unsclerotized integument of dorsum with about 17 pairs of setae, including *r*2, *r*3, *r*5 and *r*6; *r*4 is absent.

Tritosternum with base 40 μ , laciniae 75 μ . Sternal shield (32 μ $\times$ 153–156 μ) with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st*1, 75–78 μ ; between *st*1 and *st*3, 84–87 μ . Surface of shield granular, reticulated in antero-lateral corners. Genital shield (150–153 μ $\times$ 123–135 μ) granular, with one pair of setae. Anal shield (102–105 μ $\times$ 75–78 μ) with paranal setae 30 μ , postanal seta 36 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 67B. Peritreme extends to middle of coxa I; posterior part of peritrematal shield fused with podal elements of coxa IV.

Chaetotaxy of legs normal. Tarsus II with setae *av*₁ and *pv*₁ stout; many leg setae robust but not greatly thickened. Coxa II with anterior seta simple (Text-fig. 69H). Coxal spur formula (0–2–2–1). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	72/54	72/54	48/42	66/45
tibia	63/45	54/50	45/40	63/44
tarsus	98/36	84/40	84/36	105/38

HABITAT: Found on a young rabbit, Truro, Cornwall, April, 1949 (coll. Dr. F. A. Turk). Holotype female (1965: 12: 29: 30) and female paratype in the collection of the British Museum (Natural History); four female paratypes in the collection of Dr. F. A. Turk.

Hirstionyssus soricis (Turk)

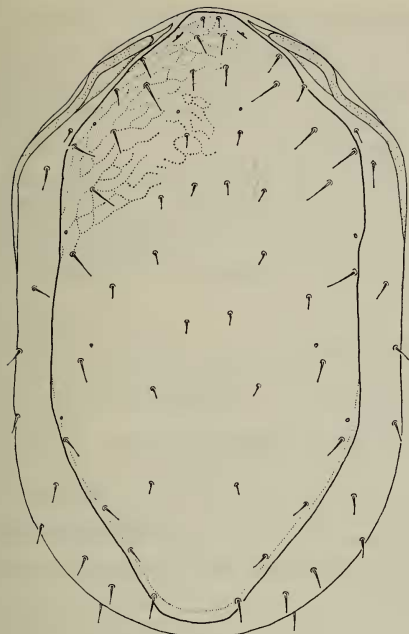
Ichoronyssus soricis Turk, 1945, *Parasitology* 36: 133, figs.

?*Hirstionyssus eusoricis* Bregetova, 1956, *Opred. Faune SSSR*. 61: 184, figs. (nom. nov. pro.

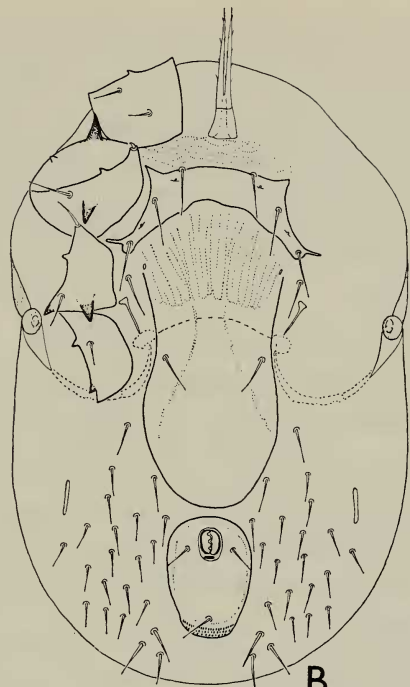
H. soricis: Zemskaya, 1955).

Female: Chelicera with segment I, 40 μ ; II, 90 μ ; movable digit 42 μ . Four

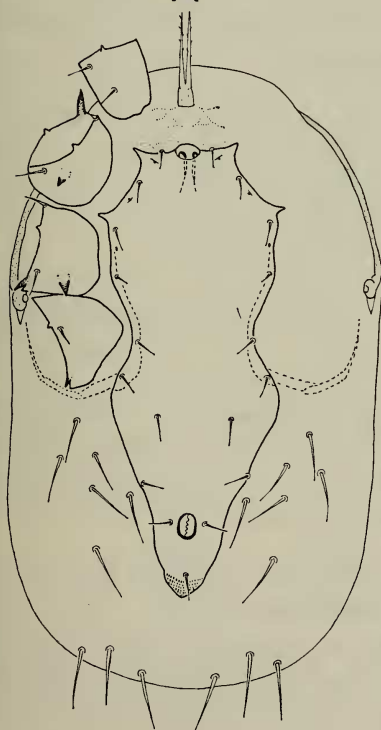
FIG. 70. *Hirstionyssus soricis* (Turk). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. venter of idiosoma of male; D. dorsum of idiosoma of male.



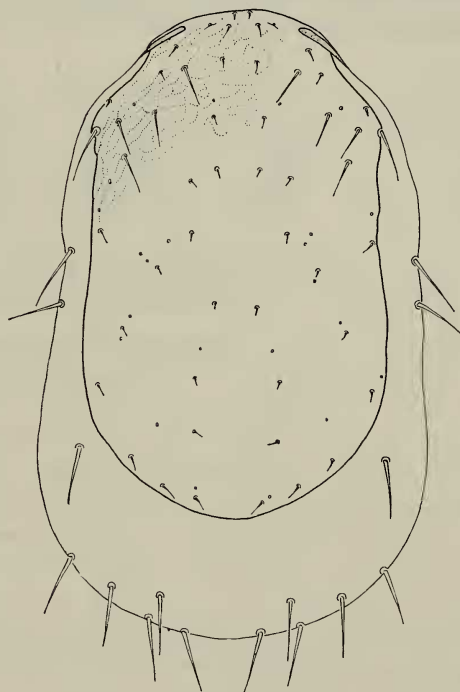
A



B



C



D

pairs of gnathosomal setae with *c.s.* about $40\ \mu$ apart, *hyp.2* about $30\ \mu$ apart. Deuto-sternum with eleven transverse rows of denticles (one or two denticles per row). Corniculi membranous, internal malae slender, elongate; salivary styli conspicuous. Tectum capituli tongue-shaped, anterior margin fimbriate. Pedipalp (2-5-6-12) with bideficient chaetotaxy on palptibia; apotele two-tined.

Dorsal shield ($490-504\ \mu \times 252\ \mu$) with 23 pairs of setae distributed as in Text-fig. 70A, seta *s6* being absent. Surface of shield with an overall reticulate pattern, but from about the level of setae *j3*, the lines show a tendency to break up into rows of punctations. About ten pairs of setae on the unsclerotized integument, including *r2*, *r3* and *r5*; *r4* and *r6* are lacking.

Tritosternum with base $36\ \mu$, laciniae $66\ \mu$. Sternal shield ($30\ \mu \times 114\ \mu$) arched, strongly concave posteriorly, with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st1*, $60\ \mu$; between *st1* and *st3*, $70-75\ \mu$. Surface of shield with reticulations in antero-lateral corners. Genital shield ($114-123\ \mu \times 96-98\ \mu$) with one pair of setae. Anal shield ($84\ \mu \times 70\ \mu$) with par- and post-anal setae subequal in length ($20-24\ \mu$). Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 70B. Peritreme extends to middle of coxa I; anterior part of peritrematal shield free, posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs normal. Tarsus II with setae *av*₁ and *pv*₁ stout and claw-like. Fairly stout setae on trochanter I (*d*), femur I (*ad*₁ and *pd*₁₋₂), femur II (*ad*₁ and *pd*₁), femora III and IV (*ad*₁₋₂). Coxa II with anterior seta short and stout. Coxal spur formula (0-2-2-1). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	54/45	54/45	38/38	48/40
tibia	50/40	42/42	36/36	48/36
tarsus	80/34	60/36	63/33	78/33

Male: Chelicera with segment I, $45\ \mu$; II, $80\ \mu$; spermadactyl $45\ \mu$ from base of movable digit. Four pairs of gnathosomal setae with *c.s.* about $42\ \mu$ apart, *hyp.2* about $27\ \mu$ apart. Other gnathosomal features as in female.

Dorsal shield ($480\ \mu \times 276\ \mu$) with 25 pairs of setae distributed as in Text-fig. 70D; *r2* and *r3* are situated on the shield. Setae *z2*, *z4*, *s3*, *s4* and *r3* are considerably longer than the other setae on the shield. Marginal areas of shield reticulated, the central region being mainly granular. Unsclerotized integument with eight pairs of setae including *r5*; *r4* and *r6* are absent.

Holovenral shield ($408\ \mu \times 102\ \mu$) with four pairs of setae and three pairs of pores in the sternal region, four pairs of setae in the genito-ventral region. Between *st1*, $48\ \mu$; between *st1* and *st3*, $87\ \mu$. Paranal setae $20\ \mu$, postanal seta $25\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 70C. Peritreme extends to middle of coxa I, and is fused anteriorly with dorsal shield; peritrematal shield free posteriorly.

Chaetotaxy of legs normal. Tarsus II with setae av_1 and pv_1 stout and claw-like. Several thickened dorsal setae present as in female. In addition, very stout, spine-like setae are present on the following segments: tibia II (pv); femur IV (al and v); genu and tibia IV (av); tarsus IV (av_1 and mv). Moderately stout setae are present on femur III (al and v) and genu III (av). Seta mv on tarsus II and all the ventral setae on tarsus III are thickened basally, tapering to long, fine points. Coxa II with anterior seta short and stout. Coxal spur formula (0-2-2-1). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	54/40	63/45	45/36	66/42
tibia	50/33	45/42	42/33	57/42
tarsus	70/30	57/33	75/30	84/30

Deutonymph: Chelicera with segment I, 30 μ ; II, 75 μ ; movable digit 33 μ . Four pairs of gnathosomal setae with c.s. about 36 μ apart, $hyp.2$ about 24 μ apart. Deutosternum with ten rows of denticles (one to two denticles per row). Tectum capituli with anterior margin smooth. Other gnathosomal features as in female.

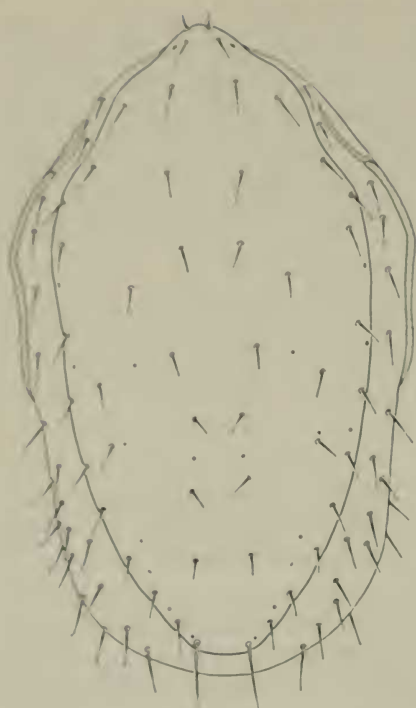
Dorsal shield (336 $\mu \times$ 144-162 μ) with 21 pairs of setae distributed as in Text-fig. 71C; s_1 and s_2 are off the shield. Terminal setae (Z_5) more than twice as long as the other setae on the shield. Surface of shield reticulated, the "lines" consisting of rows of punctations. Unsclerotized integument of dorsum with about 19 pairs of setae, including s_1 , s_2 , r_2 , r_3 and r_6 .

Tritosternum with base 27 μ , laciniae 54 μ . Sternal shield (153-168 $\mu \times$ 93-98 μ) with four pairs of setae and three pairs of pores; metasternal setae shorter than the sternals. Between st_1 , 48 μ ; between st_1 and st_3 , 81-84 μ . One pair of genital setae situated lateral or postero-lateral to posterior tip of shield. Anal shield (40 $\mu \times$ 40 μ) with paranal setae 15-18 μ long, postanal seta 15 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 71D. Peritreme extends nearly to anterior margin of coxa II. Anterior part of peritrematal shield free, posterior part not developed.

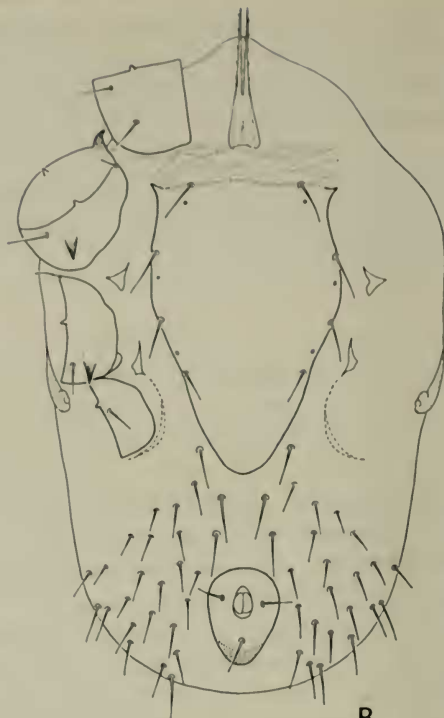
Chaetotaxy of legs normal. Tarsus II with setae av_1 and pv_1 simple. Coxal spur formula (0-2-1-0). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	42/42	42/42	36/34	36/33
tibia	42/38	40/40	33/30	38/33
tarsus	63/32	60/30	68/27	75/27

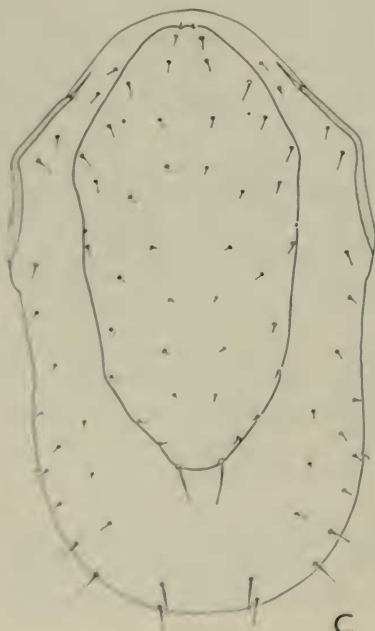
HABITAT: Found on *Sorex minutus* Linn., Camborne, Cornwall (type material from collection of Dr. F. A. Turk); *Sorex araneus* Linn., Craighouse, Jura, Inner Hebrides (coll. Dr. G. B. Corbet, 6th July, 1961), and a shrew, West Horsley, Surrey (coll. Dr. M. Burton, 22nd August, 1957).



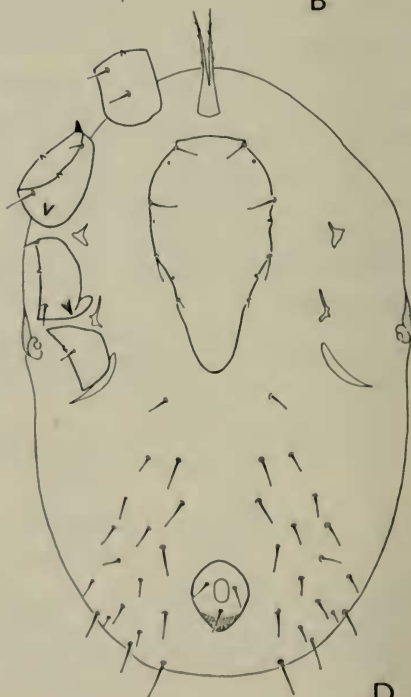
A



B



C



D

Hirstionyssus latiscutatus (de Meillon & Lavoipierre)

Liponyssus latiscutatus de Meillon & Lavoipierre, 1944, *J. ent. Soc. S. Afr.* **7**: 62.

Ichoronyssus orcadensis Turk, 1946, *Ann. Mag. nat. Hist.* (11) **12**: 786, figs. 1-7. (syn. nov.).

Hirstionyssus musculi (Johnston) Bregetova, 1956, *Opred. Faune SSSR.* **61**: 185, figs.

Female: Chelicera with segment I, 60 μ ; II, 114 μ ; movable digit 50 μ . Four pairs of gnathosomal setae with *c.s.* about 54 μ apart, *hyp.2* about 33 μ apart. Deutosternum with about 14 rows of denticles (one to three denticles per row). Corniculi membranous, internal malae slender. Tectum capituli tongue-shaped, anterior margin rounded, fringed. Salivary styli conspicuous. Pedipalp (2-5-6-14) with normal chaetotaxy (Text-fig. 72c); apotele two-tined.

Dorsal shield (552 $\mu \times$ 294 μ) with 26 or more pairs of setae distributed as in Text-fig. 72A. The setae on the opisthonotal region are variable in number and distribution. There may, for example, be one or two setae between the first and second pairs of *J* setae. Surface of shield granular, with reticulations near the antero-lateral margins; unsclerotized integument of dorsum with about 19 pairs of setae, including five pairs of *r* setae.

Tritosternum with base 45 μ , laciniae 78 μ . Sternal shield (27 $\mu \times$ 144 μ) arched, posterior margin deeply concave; with three pairs of setae and two pairs of pores; metasternal setae free with associated pores. Surface of shield granular with reticulations in the antero-lateral corners. Between *st1*, 70 μ ; between *st1* and *st3*, 72 μ . Genital shield (108 $\mu \times$ 108 μ) tongue-shaped, granular, with one pair of setae. Anal shield (84 $\mu \times$ 72 μ) with paranal setae 30 μ , postanal setae 36 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 72B. Peritreme extends to middle of coxa I; peritrematal shield fused posteriorly with podal elements of coxa IV.

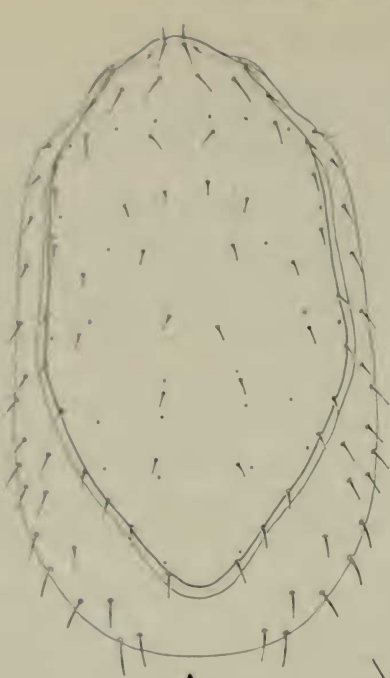
Chaetotaxy of legs normal; tarsus II with setae *av*₁ and *pv*₁ stout and claw-like. Coxal spur formula (0-2-2-1). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	63/48	63/48	45/38	63/38
tibia	63/42	50/45	45/36	60/36
tarsus	96/36	78/36	90/30	110/32

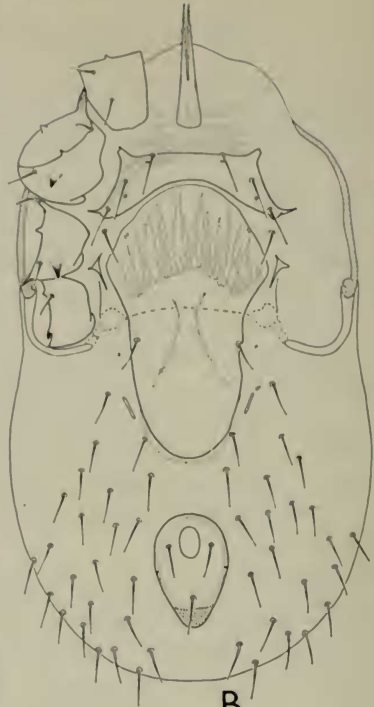
Male: Chelicera with segment I, 45 μ ; II, 90 μ ; spermadactyl 42 μ long from base of movable digit. Four pairs of gnathosomal setae with *c.s.* about 45 μ apart, *hyp.2* about 30 μ apart. Other features as in female.

Dorsal shield (468 $\mu \times$ 294 μ) with 28 or more pairs of setae distributed as in Text-fig. 72D; unsclerotized integument of dorsum with 19 pairs of setae including three pairs of *r* setae. Surface of shield granular with reticulations antero-laterally.

FIG. 71. A-B. *Hirstionyssus latiscutatus* (de Meillon and Lavoipierre), deutonymph; dorsum (A) and venter (B) of idiosoma. C-D. *Hirstionyssus soricis* (Turk), deutonymph; dorsum (C) and venter (D) of idiosoma.



A



B



C



D



E

Tritosternum with base $33\ \mu$, laciniae $72\ \mu$. Holoventral shield ($360\ \mu \times 117\ \mu$) with four pairs of setae and three pairs of pores in the sternal region, four pairs of setae in the genito-ventral region. Between *st*1, $50\ \mu$; between *st*1 and *st*3, $72\ \mu$. Paranal setae $33\ \mu$, postanal seta $27\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 72E. Peritreme extends to middle of coxa I; peritrematal shield fused anteriorly with dorsal shield, posteriorly with podal elements of coxa IV.

Chaetotaxy of legs normal. Tarsus II with setae *av*₁ and *pv*₁ stout and claw-like. Stout, spine-like setae present on genu IV (*av*), tibia IV (*av*) and tarsus IV (*av*₁ and *mv*). Coxal spur formula (0-2-2-1). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	60/40	60/42	50/38	66/40
tibia	54/36	45/42	45/36	63/36
tarsus	80/30	66/30	75/30	100/30

Deutonymph: Chelicera with segment I, $45\ \mu$; II, $72\ \mu$; movable digit $40\ \mu$. Four pairs of gnathosomal setae with *c.s.* about $40\ \mu$ apart, *hyp*.2 about $26\ \mu$ apart. Tectum capituli with anterior margin weakly denticulate. Other gnathosomal features as in female.

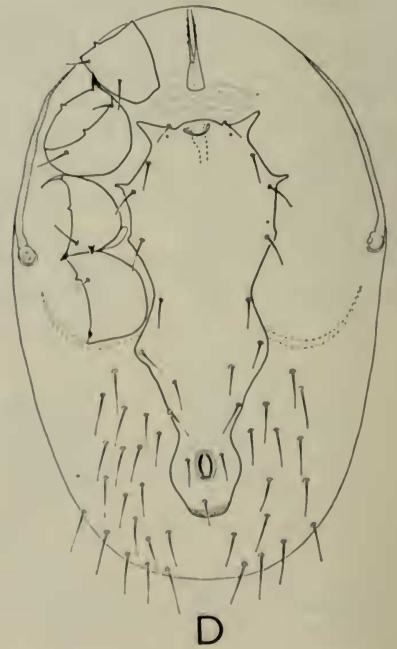
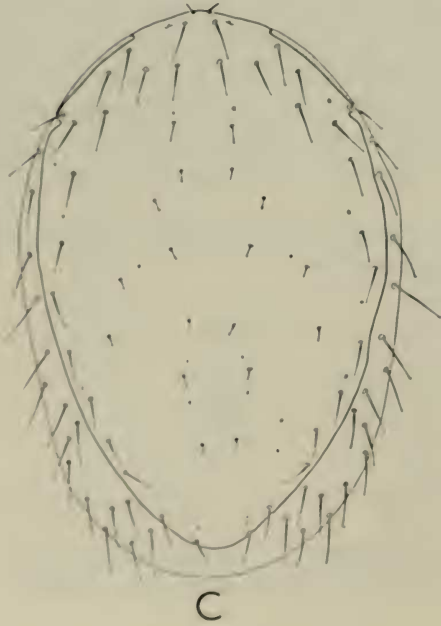
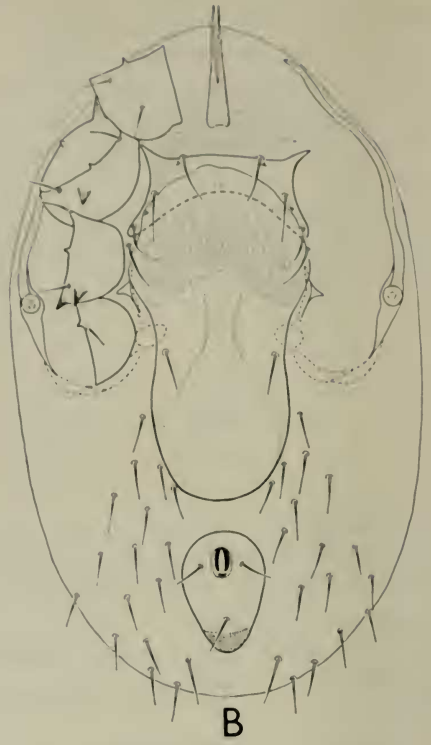
Dorsal shield ($372\ \mu \times 180\ \mu$) with 24 pairs of setae distributed as in Text-fig. 71A; unsclerotized integument with about 20 pairs of setae, including *s*1, *s*2 and five pairs of *r* setae.

Tritosternum with base $30\ \mu$, laciniae $50\ \mu$. Sternal shield ($180\ \mu \times 114\ \mu$) with four pairs of setae (sternal and metasternal) and three pairs of pores. One pair of genital setae is situated on the integument lateral to the posterior tip of the shield. Between *st*1, $66\ \mu$; between *st*1 and *st*3, $84\ \mu$. Anal shield ($45 \times 45\ \mu$); par- and postanal setae subequal in length (about $20\ \mu$). Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 71B. Peritreme extends to anterior fourth of coxa II; anterior part of peritrematal shield extends to posterior fourth of coxa I, posterior part not developed.

Chaetotaxy of legs normal. Tarsus II with setae *av*₁ and *pv*₁ simple. Coxal spur formula (0-2-1-0). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	50/42	48/42	34/36	45/36
tibia	48/38	42/40	36/34	45/33
tarsus	75/32	60/30	70/27	80/30

FIG. 72. *Hirstionyssus latiscutatus* (de Meillon & Lavoipierre). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. palptibia of female; D. dorsum of idiosoma of male; E. venter of idiosoma of male.



HABITAT: Found in Britain on *Microtus orcadensis* Millais, Scotland, and on laboratory mice, Newcastle-upon-Tyne. Also recorded from South Africa (on *Rattus rattus* (Linn.) and the U.S.S.R. (on *Rattus* species, *Mus musculus* Linn., *Apodemus* species, *Micromys minutus* (Pallas), *Microtus* species).

***Hirstionyssus isabellinus* (Oudemans)**

?*Liponyssus albato-affinis* Oudemans, 1903, *Tijdschr. Ned. dierk. Vereen.* (2) 8: 24.

Liponyssus isabellinus Oudemans, 1913, *Ent. Ber. Amst.* 3: 384, et *Arch. Naturgesch. Abt. A* 79 (9): 80, figs.

Hirstionyssus isabellinus: Bregetova, 1956, *Opred. Faune SSSR.* 61: 181, figs.

Hirstionyssus arvicolae Zemskaya, 1955, in Bregetova et al., *Opred. Faune SSSR.* 59: 366, figs. 790-792.

Female: Chelicera with segment I, 66 μ ; II, 135 μ ; movable digit 57 μ . Four pairs of gnathosomal setae with c.s. about 60 μ apart, *hyp*.2 about 40 μ apart. Deutosternum with 13 rows of denticles (one or two denticles per row). Corniculi membranous, internal malae long and slender. Tectum capituli tongue-shaped, anterior margin fimbriate. Salivary styli conspicuous. Pedipalp (2-5-6-14) with two-tined apotele.

Dorsal shield (558 $\mu \times$ 324 μ) with 27 pairs of setae distributed as in Text-fig. 73A, seta *r*₂ being on the shield. Surface of shield granular with reticulations antero-laterally. Unsclerotized integument with about 16 pairs of setae, including four pairs of *r* setae (*r*₃-*r*₆).

Tritosternum with base 42 μ , laciniae 84 μ . Sternal shield (42 $\mu \times$ 158 μ) arched, strongly concave posteriorly, with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st*₁, 84 μ ; between *st*₁ and *st*₃, 90 μ . Surface of shield granular with reticulations antero-laterally. Genital shield (156 $\mu \times$ 138 μ) granular, with one pair of setae. Anal shield (96 $\mu \times$ 87 μ) with paranal setae 33 μ , postanal seta 36 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 73B. Peritreme extends to anterior third of coxa I; anterior part of peritrematal shield free, posterior part fused with podal shields of coxa IV.

Chaetotaxy of legs normal. Tarsus II with setae *av*₁ and *pv*₁ simple. Coxal spur formula (0-2-2-0). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	66/45	66/45	45/36	63/36
tibia	66/40	50/45	42/36	60/36
tarsus	99/33	75/34	80/30	114/30

FIG. 73. *Hirstionyssus isabellinus* (Oudemans). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. dorsum of idiosoma of male; D. venter of idiosoma of male.

Male: Chelicera with segment I, $48\ \mu$; II, $87\ \mu$; spermadactyl $50\ \mu$. Four pairs of gnathosomal setae with c.s. about $42\ \mu$ apart, *hyp.2* about $30\ \mu$ apart. Other gnathosomal features as in female.

Dorsal shield ($508\ \mu \times 312\ \mu$) with 27 pairs of setae distributed as in Text-fig. 73C; unsclerotized integument of dorsum with 16 pairs of setae, including *r3-r6*.

Holovenral shield ($360\ \mu \times 108\ \mu$) with four pairs of setae in the sternal region and four pairs in the genito-ventral region. Between *st1*, $50\ \mu$; between *st1* and *st3*, $74\ \mu$. Par- and postanal setae about $27\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 73D. Peritreme extends to anterior fourth of coxa I and is fused anteriorly with the dorsal shield; posterior part of peritrematal shield weakly developed.

Chaetotaxy of legs normal. Tarsus II with setae *av*₁ and *pv*₁ stout and claw-like. Coxal spur formula (0-1-2-1). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	66/42	66/45	50/40	78/45
tibia	60/36	48/42	48/36	78/40
tarsus	90/30	80/32	78/30	120/33

HABITAT: Found in Britain on the weasel (*Mustela* sp.), Brentwood, Essex; on *Sorex araneus* Linn., Meall Greigh, Perthshire, and on *Microtus agrestis* (Linn.), Isle of Muck, Hebrides. Recorded by Oudemans from *Putorius* sp., *Arvicola terrestris* (Linn.) and *Mus musculus* Linn. in Holland, and by Bregetova from *Mustela nivalis* Linn., *Rattus norvegicus* (Berkenhout), *Microtus arvalis* (Pallas) and other rodents in the U.S.S.R.

The above description of the female is based on a specimen from *Mustela* sp. and that of the male on a specimen from *Microtus arvalis* presented by Dr. N. G. Bregetova. The male we have described differs from the male attributed to the species by Oudemans (1913, fig. 302) in lacking a ventral spur on coxa II. Oudemans lists a variety of hosts for this species and it is possible that his male and female are not conspecific.

Hirstionyssus blanchardi (Trouessart)

Leigognathus blanchardi Trouessart, 1904, *Arch. Parasitol. Paris* 8: 558.

Liponyssus blanchardi: Hirst, 1922, *Proc. zool. Soc. Lond* (1921): 787, figs.

Hirstionyssus blanchardi: Bregetova, 1956, *Opred. Faune SSSR*. 61: 177.

Female: Chelicerae with segment I, $78\ \mu$; II, $138\ \mu$; movable digit $60\ \mu$. Four pairs of gnathosomal setae with c.s. about $57\ \mu$ apart, *hyp.2* about $36\ \mu$ apart. Deutosternum with 18 rows of denticles (one or two denticles per row). Corniculi membranous, internal malae slender. Tectum capituli tongue-shaped, somewhat pointed anteriorly, margin smooth. Salivary styli conspicuous. Pedipalp (2-5-6-13) with unidifferent chaetotaxy on palptibia (Text-fig. 74B); apotele two-tined.

Dorsal shield ($660\ \mu \times 324\ \mu$) with 24 pairs of setae distributed as in Text-fig. 74A. Unsclerotized integument of dorsum with about 25 pairs of setae, including *s1*, *s2*

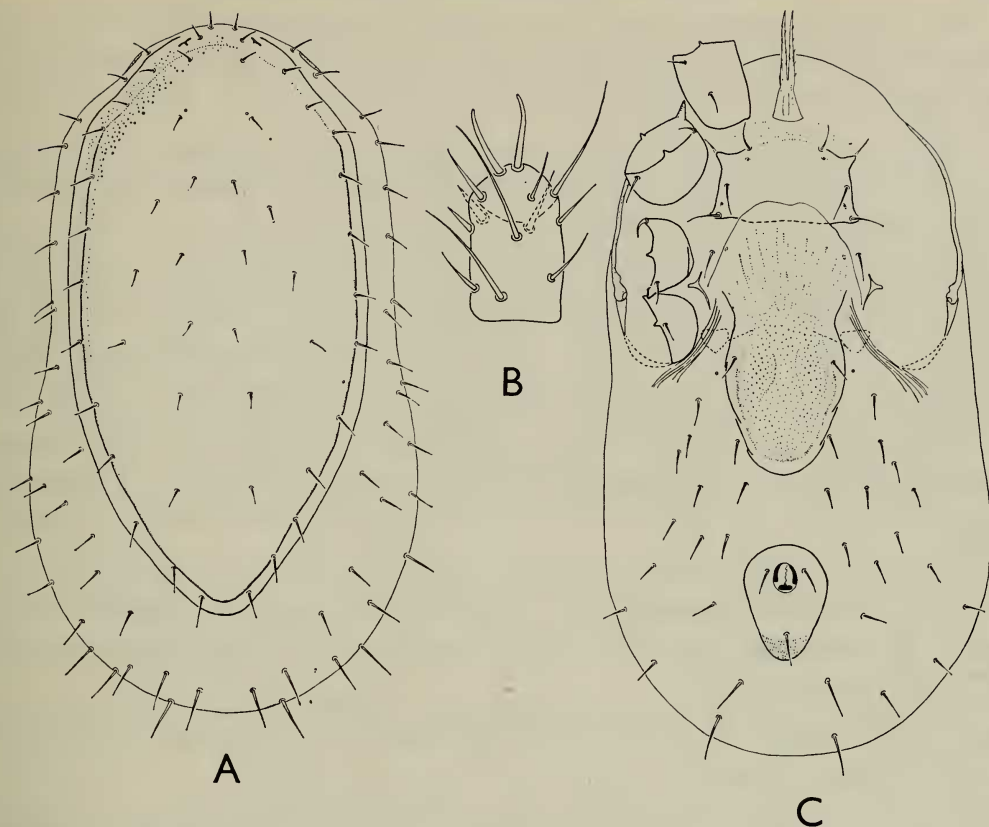


FIG. 74. *Hirstionyssus blanchardi* (Trouessart), female; dorsum of idiosoma (A); palp-tibia (B); venter of idiosoma (C).

and six pairs of *r* setae. Surface of shield granular, with a less heavily sclerotized marginal band.

Tritosternum with base $45\ \mu$, laciniae about $75\ \mu$. Sternal shield ($87\ \mu \times 141\ \mu$) rectangular, with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *stI*, $80\ \mu$; between *stI* and *st3*, $84\ \mu$. Genital shield ($132\ \mu \times 132\ \mu$) granular except for the weakly sclerotized marginal zone, bearing one pair of setae. Anal shield ($99\ \mu \times 96\ \mu$) with paranal setae $30\ \mu$, postanal seta $33\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 74C. Peritreme extends to middle of coxa I; peritrematal shield fused posteriorly with podal elements of coxa IV.

Chaetotaxy of legs normal. Tarsus II with setae *av*₁ and *pv*₁ simple. Coxal spur formula (0-1-1-0). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	84/48	84/50	66/42	90/42
tibia	80/40	—	60/40	80/40
tarsus	100/36	—	100/33	126/36

Male: Chelicera with segment I, 72 μ ; II, 117 μ ; spermadactyl 54 μ . Four pairs of gnathosomal setae with c.s. 45–52 μ apart; *hyp.2* 30–36 μ apart. Deutosternum with about 15 rows of denticles (one to two denticles per row). Other features as in female.

Dorsal shield (580–615 $\mu \times$ 324 μ) with 26 pairs of setae distributed as in Text-fig. 75A; fifteen pairs of setae on the unsclerotized integument, including six pairs of *r* setae. Surface of shield as in female.

Tritosternum with base 30 μ , laciniae 72 μ . Holoventral shield (444 $\mu \times$ 120–138 μ) with four pairs of setae and three pairs of pores in the sternal region, four pairs of setae in the genito-ventral region. Between *st1*, 60–70 μ ; between *st1* and *st3*, 87–98 μ . Surface of shield granular. Par- and post-anal setae subequal in length (about 30 μ). Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 75B. Peritreme extends to middle of coxa I; peritrematal shields free posteriorly.

Chaetotaxy of legs normal. Tarsus II with setae *av*₁ and *pv*₁ stout and claw-like. Stout spine-like setae on trochanter I (*d*), femora I and II (*ad*₁ and *pd*₁₋₂), femur III (*al* and *v*). Coxal spur formula (0–1–1–1). Legs bent, not suitable for measurement.

Deutonymph: Chelicera with segment I, 38 μ ; II, 96 μ ; movable digit 40 μ . Four pairs of gnathosomal setae with c.s. about 36–45 μ apart, *hyp.2* about 26–30 μ apart. Deutosternum with 13–16 rows of denticles (one or two denticles per row). Other features as in female.

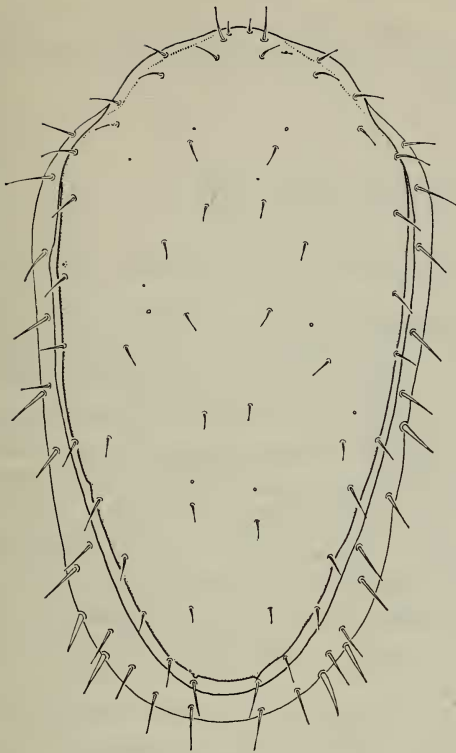
Dorsal shield (408–444 $\mu \times$ 156–210 μ) with 24 pairs of setae distributed as in Text-fig. 75C; about 20 pairs of setae on the unsclerotized integument, including *st1*, *st2* and six pairs of *r* setae.

Tritosternum with base 30 μ , laciniae 57 μ . Sternal shield (240–252 $\mu \times$ 110–120 μ) with four pairs of setae and three pairs of pores; one pair of genital setae is situated on the cuticle lateral to the posterior tip of the shield. Between *st1*, 70–72 μ ; between *st1* and *st3*, 100–108 μ . Anal shield (48–54 $\mu \times$ 50–57 μ) with par- and postanal setae subequal in length (about 15 μ). Chaetotaxy and sclerotization of venter as in Text-fig. 75D. Peritreme extends to a point between coxae I and II; anterior part of peritrematal shield short, posterior part not developed.

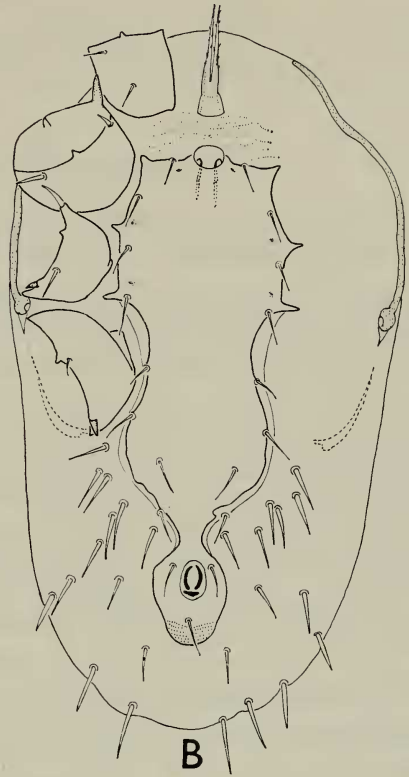
Chaetotaxy of legs normal. Tarsus II with setae *av*₁ and *pv*₁ simple. Slightly thickened setae present on femora I (*ad*₁ and *pd*₁₋₂) and II (*ad*). Coxal spur formula (0–1–0–0). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	48/40	45/42	36/36	50/38
tibia	54/36	42/38	36/34	54/36
tarsus	75/30	—	60/27	93/27

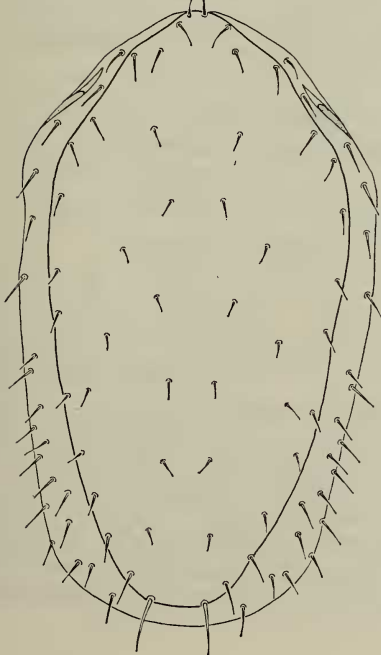
FIG. 75. *Hirtonyssus blanchardi* (Trouessart). A. Dorsum of idiosoma of male; B. venter of idiosoma of male; C. dorsum of idiosoma of deutonymph; D. venter of idiosoma of deutonymph.



A



B



C



D

HABITAT: Found on *Marmota marmota* (Linn.), the Alpine Marmot, Zermatt, Switzerland, and on *Cynomys ludovicianus* (Ord.) the Black-tailed Prairie Dog (specimens kept in captivity), Horsham, England.

Subfamily MACRONYSSINAE Oudemans

Liponyssinae Ewing, 1923, *Proc. U.S. nat. Mus.* **62** (art. 13) : 2. [see p. 240]

Macronyssidae Oudemans, 1936, *Kritisch Historisch Overzicht der Acarologie* (III) A : 430.

Adults: Chelicerae essentially chelate-edentate, digits often with membranous lobes and denticulate processes; spermadactyl relatively short and free, rarely long and entirely fused with the movable digit; fixed digit rarely shorter than the movable. Pilus dentilis absent, dorsal seta minute or absent; fissures normal; arthrodial processes rarely present. Chaetotaxy of venter of gnathosoma normal. Pedipalps with five free segments, apotele two-tined, rarely simple; chaetotaxy of trochanter to tibia normal (2-5-6-14) or with tibia unidifferent, rarely femur and genu unidifferent or tibia bidifferent. Palptrochanter usually with medio-ventral keel in female. Deutosternum with denticles in a single file, rarely with two to five denticles in a transverse row. Hypostome somewhat elongated, corniculi membranous, internal malae free or fused. Tectum capituli elongated with margins smooth, weakly denticulated or fimbriated.

Dorsal sclerotization reduced in the female, comprising an entire shield, two subequal shields or a podonotal shield, mesonotal scutellae and a small pygidial shield; male with entire dorsal shield. Primary chaetotaxy of the dorsum of the idiosoma showing hypotrachy, paravertical setae (z1) normally absent. Secondary hypertrichy of the dorsum common, particularly of the lateral and marginal series. Dorsal setae simple, pilose or subspinose.

Tritosternum bipartite, laciniae smooth or pilose and often with denticulate, hyaline, lateral margins. Sternal shield in female with two or three pairs of setae and two pairs of pores; metasternal setae free, rarely absent. "Porose areas" present in the region of the first pair of sternal pores or posterior margin of sternal shield with a strongly sclerotized band in some chiropteran parasites. Genital shield usually tapering posteriorly and bearing the genital setae (except in *Ophionyssus*); opisthogastric setae may be present on the shield. Anal shield normal, aciculated area conspicuous, no euanal setae. Opisthogastric cuticle invariably hypertrichous. Metapodal shields small, relatively inconspicuous. Peritrematal shield fused with podal shields posterior to coxae IV; peritemes of varying lengths. Podal shields weakly developed. Male with holoventral shield; sternito-genital and ventro-anal shields; sternito-genital, ventral and ventro-anal shields; sternito-genital, ventral and anal shields; or sternito-genital and anal shields. Genital orifice presternal.

All legs six-segmented and with well developed ambulacra. Segmental chaetotaxy extremely diverse, never entirely normal. Coxae II-IV may have sclerotized ridges of varying degrees of development. Anterior spine of coxa II usually large, rarely minute or absent.

Larva: Inactive non-feeding instar. Chelicerae with digits minute, edentate and lacking setae, fissures and arthrodial processes. Pedipalps five-segmented; chaetotaxy of tibia and tarsus deficient. Hypostome with two pairs of setae, corniculi degenerate, deutosternal denticles weak or absent. Idiosoma without distinct sclerotization. Podonotal region with eight or nine pairs of setae, opisthonotal region with three pairs of relatively long setae. Tritosternum bipartite but laciniae strongly reduced. Sternal region with normal three pairs of setae, opisthogastric region with two pairs, normal three setae associated with the non-functional anus. Stigmata and peritremes absent. Leg chaetotaxy normal for this instar. The larval stage is known only for a few species (*Ornithonyssus*, *Macronyssus* and *Ophionyssus*)

Protonymph: Active feeding instar. Chelicerae, basis capituli and hypostome with the characteristics of the female. Pedipalpal chaetotaxy normal (1-4-5-12), palptrochanter rarely with medio-ventral keel.

Dorsal sclerotization comprising well developed podonotal, mesonotal and pygidial elements. Podonotal shield usually with 10 or 11 pairs of setae, pygidial shield with two to seven pairs, hypertrichy of lateral and marginal series of setae of the opisthonotum common. Tritosternum as in female. Sternal shield with three pairs of setae and two pairs of pores, genital setae present, anal shield normal. Opisthogastric cuticle usually with four pairs of setae, hypertrichy of opisthogaster rare. Stigmata and short peritremes present. Chaetotaxy of legs normal for this instar except on genu IV ($2-\frac{2}{0}$, $\frac{2}{0}-1$) in *Ophionyssus*.

Deutonymph: Inactive, non-feeding instar characteristic of the macronyssines. Chelicerae degenerate, digits minute, hypostome with discrete corniculi and internal malae, deutosternal denticles as in female, gnathosomal setae normal. Pedipalps (2-5-6-12/13). Idiosoma without distinct sclerotization. Sexual dimorphism apparent in the dorsal and opisthogastric chaetotaxy, the male and female deutonymphs having similar chaetotaxy to the adult male and female respectively. Tritosternum simple, bipartite only at its tip. Intercoxal region with four (metasternals absent) or five pairs of setae. Stigmata, peritremes and segmental chaetotaxy of the legs as in the adult.

KEY TO THE GENERA OF THE BRITISH MACRONYSSINAE

FEMALES

- 1 Dorsum of the idiosoma partially covered by discrete, subequal, podonotal and opisthonotal shields **STEATONYSSUS** (p. 329)
- Dorsum of the idiosoma with an entire shield or, if with two or more scutal elements, the pygidial shield is relatively minute 2
- 2 Genu and tibia III each with one postero-lateral seta (genu $2-\frac{2}{1}$, $\frac{2}{1}-1$; tibia $2-\frac{1}{1}$, $\frac{2}{1}-1$); tritosternum without hyaline denticulate border; "porose" areas present in region of first pair of sternal pores; fixed digit of chelicera with distal acuminate lobe and retrose denticular processes, movable digit with dorsal hyaline flap usually with denticular processes; sclerotized ridges of varying degrees of development usually present on ventral surfaces of coxae II-IV
MACRONYSSUS (p. 303)

- Genu and tibia III each with two postero-lateral setae (genu $2-\frac{2}{1}, \frac{2}{1}-2$; tibia $2-\frac{1}{1}, \frac{2}{1}-2$); tritosternum with hyaline denticulate border; "porose" areas absent on sternal shield; cheliceral digits with membranous lobes but usually lacking denticular processes; without sclerotized ridges on coxae II-IV 3
- 3 Genu IV with two postero-lateral setae ($2-\frac{2}{1}, \frac{2}{1}-2$ or $2-\frac{2}{1}, \frac{3}{1}-2$); genital setae on integument; ectoparasites of reptiles **OPHIONYSSUS** (p. 335)
- Genu IV with one postero-lateral seta ($2-\frac{2}{1}, \frac{3}{1}-1$); genital setae situated on the genital shield; ectoparasites of birds and mammals **ORNITHONYSSUS** (p. 313)

MALES

- 1 Ventral sclerotization comprising discrete sternito-genital and anal shields; genu IV with two posterolateral setae ($2-\frac{2}{1}, \frac{2}{1}-2$ or $2-\frac{2}{1}, \frac{3}{1}-2$) **OPHIONYSSUS**
- Ventral sclerotization comprising holovenal shield, sternito-genital and ventro-anal shields or sternito-genital, ventral and ventro-anal shields, never with discrete anal shield; genu IV with one postero-lateral seta ($2-\frac{2}{1}-\frac{3}{1}-1$) 2
- 2 Genu and tibia III each with one postero-lateral seta, segments respectively with nine and eight setae; tritosternum with a hyaline denticulate border **MACRONYSSUS**
- Genu and tibia III each with two postero-lateral setae, segments respectively with ten and nine setae; tritosternum with a hyaline denticulate border 3
- 3 Movable digit of chelicera with a membranous lobe between the spermadactyl and the digit; ectoparasites of Chiroptera **STEATONYSSUS**
- Movable digit without membranous lobe between the spermadactyl and the digit; ectoparasites of birds and mammals **ORNITHONYSSUS**

KEY TO THE PROTONYMPHS OF THE BRITISH MACRONYSSINAE

- 1 Genu IV with six setae ($1-\frac{2}{0}, \frac{2}{0}-1$) 2
- Genu IV with five setae ($1-\frac{2}{0}, \frac{2}{0}-0$) 3
- 2 Pygidial shield with three pairs of setae (Text-fig. 92A) **Ophionyssus natricis** (Gervais) (p. 340)
- Pygidial shield with two pairs of setae (Text-fig. 92C) **Ophionyssus saurorum** (Oudemans) (p. 344)
- 3 Podonotal seta j_3 and opisthonotal seta J_5 absent (Text-fig. 84A) 4
- Podonotal seta j_3 and opisthonotal seta J_5 present (Text-fig. 88A) 5
- 4 Pygidial shield with four pairs of setae; podonotal setae j_5 about equal in length to the distance between the bases of setae j_5 and z_5 **Ornithonyssus bacoti** (Hirst) (p. 324)
- Pygidial shield with three pairs of setae; podonotal setae j_5 less than one half the length of the distance between the bases of setae j_5 and z_5 **Ornithonyssus sylviarum** (Canestrini & Fanzago) (p. 321)
- 5 Pygidial shield with four pairs of setae (Text-fig. 88A) 6
- Pygidial shield with five to seven pairs of setae 7
- 6 Pygidial shield with setae Z_4 , S_5 and Z_5 subequal **Steatonyssus periblepharus** Kolenati (p. 333)
- Pygidial shield with setae Z_4 , S_5 and Z_5 increasing in size in that order **Steatonyssus occidentalis** (Ewing)
- 7 Pygidial shield with seven pairs of setae 8
- Pygidial shield with five or six pairs of setae 9

- 8 Unsclerotized integument of idiosoma with 16 pairs of setae (excluding *j*₁), Text-fig. 79A-B. *Macronyssus kolenatii* (Oudemans) (p. 314)
- Unsclerotized integument of idiosoma markedly hypertrichous (Text-fig. 79C-D) *Macronyssus flavus* (Kolenati) (p. 310)
- 9 Pygidial shield with five pairs of setae *Macronyssus ellipticus* (Kolenati) (p. 307)
- Pygidial shield with six pairs of setae IO
- 10 Tritosternum with denticulate, hyaline border. Pygidial shield truncated or slightly concave anteriorly; its width at least twice its length; setae *J*₄ situated on the anterior margin of the shield. *Ornithonyssus pipistrelli* (Oudemans) (p. 329)
- Tritosternum without denticulate, hyaline border. Pygidial shield convex anteriorly; its width not more than 1½ times its length; setae *J*₄ well removed from the anterior margin of the shield. *Macronyssus uncinatus* (Canestrini)

Genus *MACRONYSSUS* Kolenati

Macronyssus Kolenati, 1858, *Wien. ent. Monatschr.* 2: 5.

Lepronyssus Kolenati, 1858, *Wien. ent. Monatschr.* 2: 5.

Allonyssus Buitendijk, 1945, *Zool. Med.* 24: 307 (syn. nov.).

Hirstesia Fonseca, 1948, *Proc. zool. Soc. Lond.* 118: 267.

Type: *Caris longimana* Kolenati, 1857.

Chelicerae chelate, essentially edentate, fixed digit of the female usually produced distally into an acuminate lobe and with up to three retrose denticular processes in its distal half; movable digit with a strong dorsal hyaline flap usually with denticular processes in its anterior half. Movable digit of male with a grooved spermadactyl, its free portion extending beyond the tip of the digit by about the length of the digit, rarely longer (*M. ellipticus*). Pilus dentilis apparently absent, dorsal seta present, fissures normal. Arthrodial processes absent or in the form of microprocesses. Chaetotaxy of venter of gnathosoma normal, pedipalp with five free segments and a two-tined apotele. Chaetotaxy of pedipalps, trochanter to tibia (2-5-6-14), rarely (2-5-6-13) as in *M. ellipticus*. Palptrochanter with a conspicuous ventral keel. Deutosternum with 8-12 rows of denticles arranged in a single file, or some rows comprising two to five denticles. Corniculi membranous, internal malae simple. Tectum capituli elongate, tapering distally to an obtuse point.

Entire dorsal shield with 21-28 pairs of setae in the female, 21-29 pairs in the male; paravertical setae (*z*₁) absent.

Tritosternum normal, bipartite, lacking denticulate hyaline border. Sternal shield of the female with three pairs of setae and two pairs of pores. "Porose" areas present in the region of the first pair of sternal pores, weakly or strongly defined. Genital shield tapering posteriorly and with genital setae only; weakly sclerotized area extending from posterior margin of the genital shield with one to several setae in some species. Anal shield pear-shaped, with normal chaetotaxy; region posterior to postanal seta often markedly elongated. Metapodal shields poorly defined. Opisthogastric cuticle shows hypertrichy. Peritrematal shields fused with the podal shields posterior to coxae IV. Podal shields weakly developed. Male with holo-

ventral shield, with sternito-genital and ventro-anal or with sternito-genital, ventral and ventro-anal shields. Presternal area in both sexes weakly sclerotized.

Chaetotaxy of legs normal except genu IV which has two ventral setae ($2-\frac{2}{1}$, $\frac{3}{1}-1$). Coxa II with prominent anterior spine. Sclerotized ridges of varying degrees of development usually present on ventral surfaces of coxae II-IV. All ambulacra with well-developed claws.

Protonymph with dorsum of idiosoma normally bearing 29 pairs of setae. Podo-notal shield with ten pairs of setae, verticals on the integument. Pygidial shield with seven pairs of setae. Normal complement of setae reduced by absence of one or two pairs of setae on the pygidial shield, or increased by hypertrichy of lateral unsclerotized integument. Venter with three pairs of sternal setae, one pair of genital and four pairs of opisthogastric setae. Opisthogaster may show hypertrichy. Anal shield with normal complement of setae. Gnathosoma essentially as in female. Chaetotaxy of legs and pedipalps normal.

KEY TO FEMALES

- 1 Opisthonotal region of the dorsal shield with nine pairs of setae (*J* series deficient, Text-fig. 76A) ; majority of deutosternal denticles compound (Text-fig. 76c). 2
- Opisthonotal region of the dorsal shield with 12 pairs of setae ; deutosternal denticles simple, in a single file (Text-fig. 77B) 3
- 2 Sternal " porose " areas weakly defined, irregular (Text-fig. 76B) ; peritreme reduced, extending to the level of the posterior third of coxa II ; podonotal region with 12 pairs of setae, *ji* on integument (Text-fig. 76A) *M. ellipticus* (Kolenati) (p. 306)
- Sternal " porose " areas conspicuous, subcircular, bordered by a sclerotized ring (Text-fig. 81B) ; peritreme extending to the level of the middle of coxa I ; podonotal region with 14 pairs of setae, *ji* on shield (Text-fig. 81A) *M. uncinatus* (Canestrini) (p. 315)
- 3 Bases of setae *z6*, *Z1* and *S1* lying more or less in a straight line (Text-fig. 80A) ; sternal " porose " areas as in Text-fig. 80B ; lateral and opisthogastric cuticle moderately setose *M. kolenatii* (Oudemans) (p. 312)
- Seta *z6*, *Z1* and *S1* forming more or less the points of an equilateral triangle (Text-fig. 78A) ; sternal " porose " areas as in Text-fig. 78B ; lateral and opisthogastric cuticle densely setose *M. flavus* (Kolenati) (p. 308)

KEY TO MALES

- 1 Spermadactyl extremely long, about as long as the second cheliceral segment *M. ellipticus* (Kolenati) (p. 306)
- Spermadactyl obviously shorter in length than the second cheliceral segment 2
- 2 Three pairs of dorsal marginal setae stout, thorn-like ; ventral sclerotization comprising separate sternito-genital, ventral and ventro-anal shields *M. uncinatus* (Canestrini)
- None of the marginal setae conspicuously enlarged ; without separate ventral shield 3
- 3 Sternito-genital and ventro-anal shield distinctly separated (Text-fig. 78D) ; unsclerotized dorsal integument with numerous short setae (Text-fig. 78c) *M. flavus* (Kolenati) (p. 310)
- With a holovenral shield ; sternito-genital and ventro-anal regions connected at the level of the posterior margin of coxae IV (Text-fig. 80D) ; unsclerotized dorsal integument with about seven pairs of setae *M. kolenatii* (Oudemans) (p. 314)

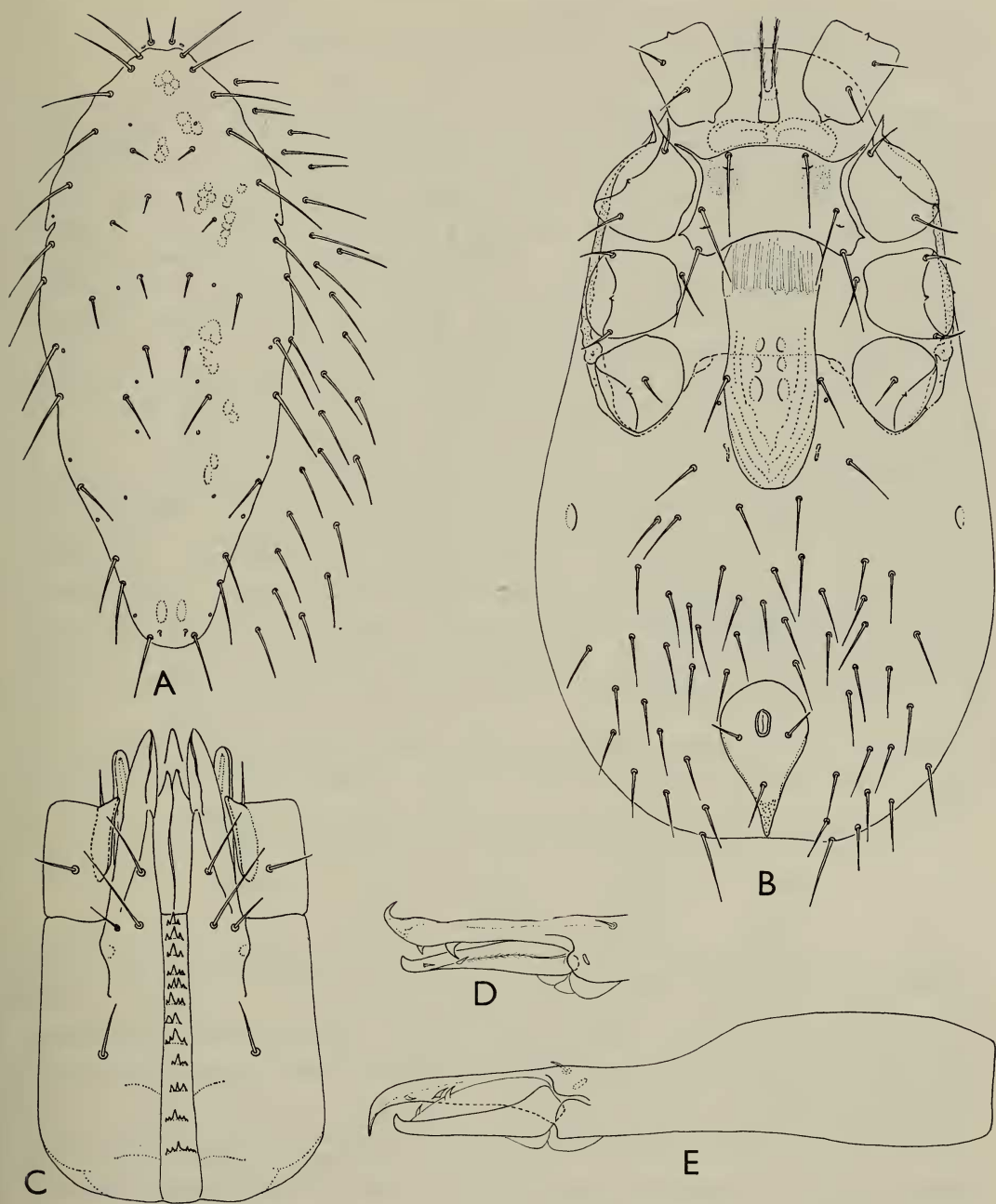


FIG. 76. *Marconyssus ellipticus* (Kolenati), female; dorsal shield (A); venter of idiosoma (B); venter of gnathosoma (C); chelicera (D-E).

Macronyssus ellipticus (Kolenati)

Caris elliptica Kolenati, 1857, *Parasit. Chiropt.* : 16.

Liponyssus ellipticus; Hirst, 1922, *Proc. zool. Soc. Lond.* (1921) : 795, fig. 36.

Ichoronyssus mohrae Vitzthum, 1932, *Z. Parasitenk.* 4 : 32.

Female : Chelicera with segment I, 45 μ ; II, 170 μ ; movable digit 42 μ long, hooked terminally, dorsal hyaline flap with two denticulate processes. Fixed digit with two denticulate processes and a pointed distal process which appears variously shaped depending on the orientation of the chelicera (Text-figs. 76D and E). Pilus dentilis absent, dorsal seta present. Four pairs of gnathosomal setae with c.s. about 60 μ apart, *hyp.2* about 45 μ apart. Deutosternum with 12 transverse rows of denticles (two to five denticles per row). Corniculi membranous, internal malae simple, tectum capituli tapering. Pedipalp (2-5-6-13) with two-tined apotele ; palptrochanter with conspicuous ventral keel (Text-fig. 76C).

Dorsal shield (774 $\mu \times$ 348 μ) with about 20 pairs of setae distributed as in Text-fig. 76A ; setae *j1* off the shield. Surface of shield with sculptured areas and a weak reticulate pattern. Unsclerotized integument of dorsum hypertrichous.

Tritosternum with base 36 μ , laciniae 114 μ . Sternal shield (105 $\mu \times$ 174 μ) with irregular punctate areas in the antero-lateral corners ; with three pairs of setae and two pairs of pores ; metasternal setae free. Between *st1*, 80 μ ; between *st1* and *st3*, 117 μ . Genital shield (135 $\mu \times$ 102 μ) with genital setae only. Anal shield (117 $\mu \times$ 100 μ) pear-shaped with strongly arched anterior margin ; paranal setae about 40 μ long, postanal seta about 54 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 76B. Peritreme extends to posterior third of coxa II ; peritrematal shield free anteriorly ; posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs normal except genu IV which has two ventral setae (2— $\frac{2}{1}$, $\frac{3}{1}$ —1). Coxa II with prominent anterior spine. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	120/60	102/66	84/57	144/60
tibia	114/54	84/60	90/54	132/54
tarsus	192/48	162/54	180/48	240/50

Male : Chelicera with segment I, 30 μ ; II, 123 μ ; movable digit 36 μ long, broad, weakly sclerotized ; spermadactyl greatly enlarged, 87 μ long from base of movable digit, boat-shaped. Fixed digit edentate. Four pairs of gnathosomal setae with c.s. about 50 μ apart, *hyp.2* about 42 μ apart. Other gnathosomal features as in female.

Dorsal shield (648 $\mu \times$ 288 μ) with 26 pairs of setae. Sternito-genital shield (270 $\mu \times$ 138 μ) with four pairs of long sternal and a pair of short genital setae. Between *st1*, 63 μ ; between *st1* and *st3*, 110 μ . Ventro-anal shield with irregular lateral margins ; bearing six asymmetrically arranged setae excluding the anals. Paranal setae 33 μ , postanal seta 42 μ long. Peritreme extends to about middle of coxa II.

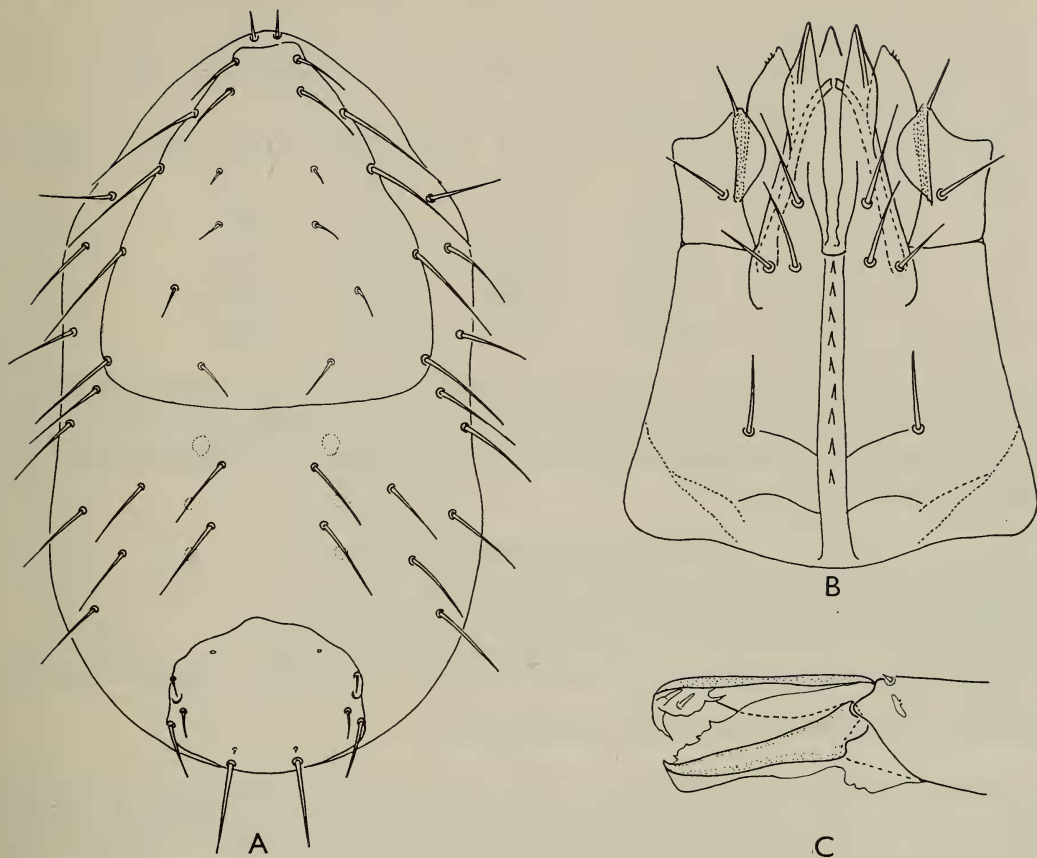


FIG. 77. A. *Macronyssus ellipticus* (Kolenati), protonymph; dorsum of idiosoma. B-C. *Macronyssus flavus* (Kolenati), female; venter of gnathosoma (B); chelicera (C).

Chaetotaxy of legs as in female. Some relatively long, stout setae on femur I (ad_1 and pd_1) and femur II (ad_1 and pd_{1-2}). Legs bent and not suitable for measurement.

Protonymph: Chelicera with segment I, $30\ \mu$; II, $114\ \mu$; movable digit $33\ \mu$. Gnathosoma essentially as in female. Four pairs of gnathosomal setae with *c.s.* about $45\ \mu$ apart, *hyp.2* about $36\ \mu$ apart. Deutosternum with 12 transverse rows of denticles (one to four denticles per row). Pedipalp (1-4-5-12) with two-tined apotele; trochanter with conspicuous ventral keel.

Podonotal shield ($282\ \mu \times 216\ \mu$) with ten pairs of setae as in Text-fig. 77A; setae $j1$ situated in front of shield. Pygidial shield ($114\ \mu \times 144\ \mu$) with anterior margin convex; bearing five pairs of setae. Unsclerotized integument of dorsum bears 11 pairs of setae.

Tritosternum with base $30\ \mu$, laciniae $100\ \mu$. Sternal shield ($180\ \mu \times 126\ \mu$) with three pairs of setae and two pairs of pores. Between *st*1, $70\ \mu$; between *st*1 and *st*3, $117\ \mu$. Anal shield ($66\ \mu \times 66\ \mu$) with paranal setae $36\ \mu$, postanal seta $45\ \mu$ long. Peritreme extends to middle of coxa III.

Chaetotaxy of legs normal. Coxa II with conspicuous anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	70/52	66/54	54/48	75/48
tibia	66/45	51/48	48/45	68/45
tarsus	120/40	90/40	90/40	135/40

HABITAT: Ectoparasitic on *Myotis myotis* (Borkhausen), *M. daubentonii* (Kuhl) and *M. nattereri* (Kuhl) in Suffolk, England. Recorded from *Myotis* species and also from *Rhinolophus ferrumequinum* (Schreber), *R. hipposideros* (Bechstein) and *Plecotus auritus* (Linn.) in Europe.

Macronyssus flavus (Kolenati)

Dermanissus flavus Kolenati, 1857, *Parasit. Chiropt.*: 19.

Lepronyssus flavus Kolenati, 1859, *S.B. Akad. Wiss. Wien.* **35**: 184.

Liponyssus flavus: Hirst, 1922, *Proc. zool. Soc. Lond.*: 791, figs. 34-35.

Liponyssus lobatus: Oudemans, 1903, *Tijdschr. Ned. dierk. Vereen.* (2) **8**: 18, figs. (non Kolenati, 1857).

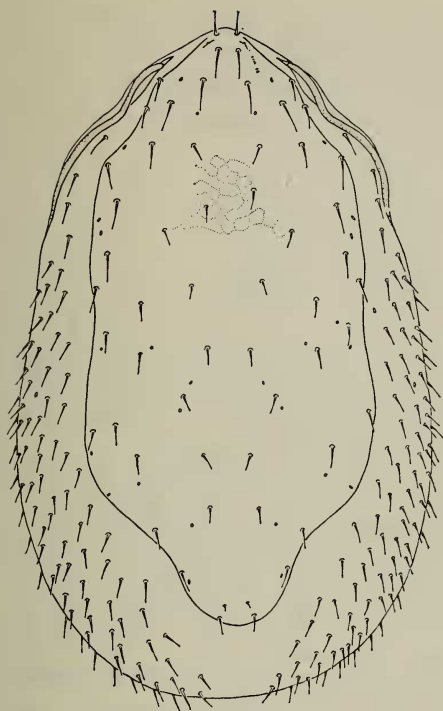
Liponyssus britannicus Radford, 1941, *Parasitology* **33**: 311.

Female: Chelicera with segment I, $42\ \mu$; II, $144\ \mu$; movable digit $45\ \mu$ long, with a dorsal, hyaline flap which is irregularly denticulate in its anterior half. Fixed digit with an acuminate terminal lobe and three retrose denticular processes in its distal half (Text-fig. 77C). Pilus dentilis absent, dorsal seta minute. Four pairs of gnathosomal setae with c.s. $50\ \mu$ apart, *hyp*.2 about $36\ \mu$ apart. Deutosternum with nine denticles arranged in a single file. Corniculi membranous, internal malae simple. Tectum capituli elongate, pointed distally. Pedipalp (2-5-6-14) with two-tined apotele. Palptrochanter with a conspicuous ventral keel (Text-fig. 77B).

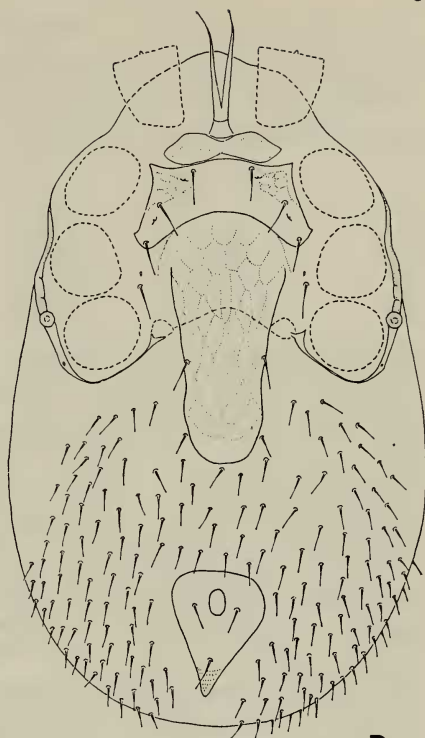
Dorsal shield ($624\ \mu \times 288\ \mu$) with 28 pairs of simple setae distributed as in Text-fig. 78A. Surface of shield reticulated. Unsclerotized integument of dorsum shows marked hypertrichy.

Tritosternum with base $33\ \mu$, laciniae $105\ \mu$. Sternal shield ($66\ \mu \times 168\ \mu$) with a distinct reticulate pattern in the antero-lateral corners, bearing three pairs of setae and two pairs of pores; metasternal setae free with associated pores. Between *st*1, $54\ \mu$; between *st*1 and *st*3, $96\ \mu$. Genital shield ($117\ \mu \times 84\ \mu$) with an overall reticulate pattern, bearing one pair of genital setae. Anal shield ($90\ \mu \times 96\ \mu$) with par- and postanal setae about $24\ \mu$ long. Sclerotization and chaetotaxy of opistho-

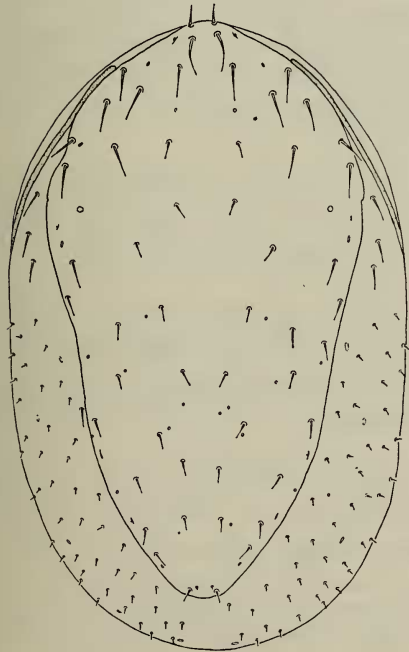
FIG. 78. *Macronyssus flavus* (Kolenati). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. dorsum of idiosoma of male; D. venter of idiosoma of male.



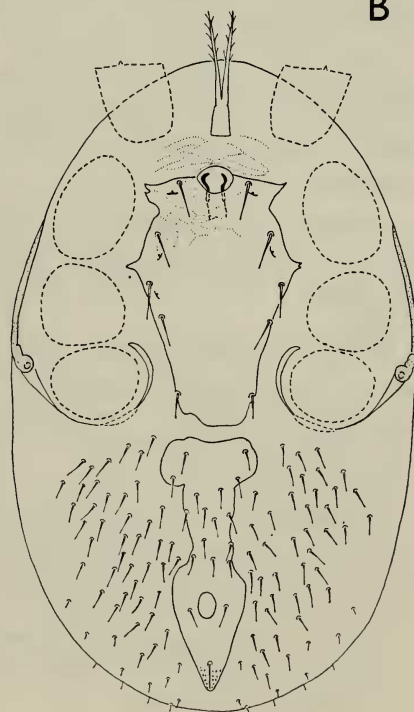
A



B



C



D

gaster as in Text-fig. 78B. Peritreme extends to anterior third of coxa I; peritrematal shield free anteriorly; posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs normal except genu IV which has two ventral setae ($2-\frac{2}{1}, \frac{3}{1}-1$). Coxae II with large anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	72/50	72/57	48/45	66/45
tibia	72/45	58/54	48/45	60/42
tarsus	105/40	70/48	78/42	126/40

Male: Chelicera with segment I, 24 μ ; II, 81 μ ; movable digit 30 μ long, strongly hooked terminally; spermadactyl grooved, 45 μ long from base of movable digit. Fixed digit edentate. Four pairs of gnathosomal setae with c.s. about 45 μ apart, *hyp.2* about 38 μ apart. Other gnathosomal features as in female.

Dorsal shield (540 $\mu \times$ 252 μ) with 27 or 28 pairs of setae as in Text-fig. 78C. Unsclerotized integument of opisthonotum bears numerous very short, fine setae.

Tritosternum with base 20 μ , laciniae 96 μ . Sternito-genital shield (240 $\mu \times$ 129 μ) reticulated, with five pairs of setae and three pairs of pores. Between *st1*, 63 μ ; between *st1* and *st3*, 96 μ . Ventro-anal shield (204 $\mu \times$ 66 μ) with about fifteen setae excluding the anals; par- and postanal setae about 20 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 78D. Peritreme extends to middle of coxa I; peritrematal shield fused anteriorly with dorsal shield; posterior part fused with podal elements of coxa IV.

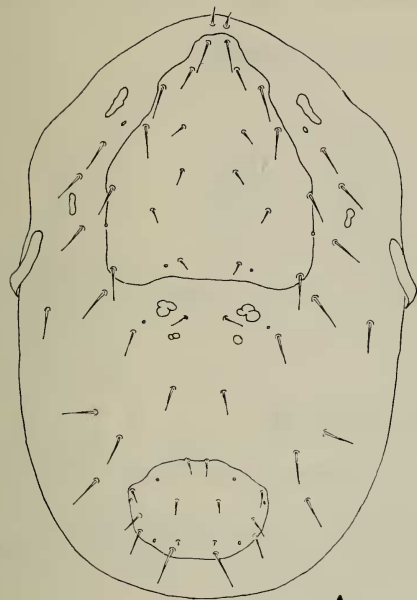
Chaetotaxy of legs as in female. Leg II with some setae situated on small tubercles (anterior seta on coxa; *av* on femur; *av*₁, *pv*₁ and *mv* on tarsus). Setae *pd* and *pv*₁ on genu IV and dorsal setae on femur IV stout and spine-like. Coxa II with anterior spine. Length/width (in μ) of leg segments not measurable in the single male we have examined.

Protonymph: Chelicera with segment I, 30 μ ; II, 110 μ ; movable digit 33 μ . Four pairs of gnathosomal setae with c.s. about 36 μ apart; *hyp.2* about 30 μ apart. Pedipalp (I-4-5-12) with two-tined apotele. Other gnathosomal features as in female.

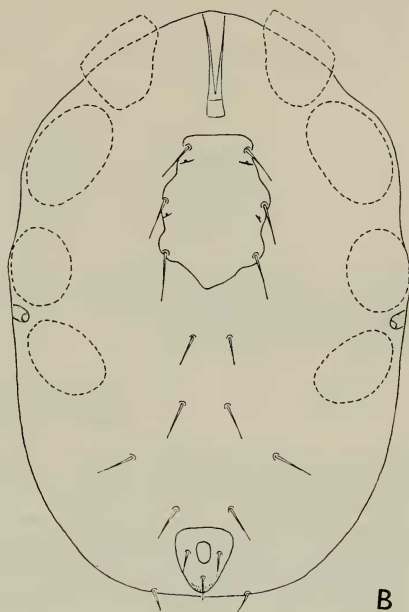
Podonotal shield (240 $\mu \times$ 162 μ) with ten pairs of setae (Text-fig. 79C), *j1* situated on the unsclerotized integument. Pygidial shield slightly wider than long, with seven pairs of setae. Two pairs of mesonotal scutellae present between the anterior and posterior dorsal shields. Unsclerotized integument of opisthonotum markedly hypertrichous.

Tritosternum with base 26 μ , laciniae 84 μ . Sternal shield (150 $\mu \times$ 100 μ) with three pairs of setae and two pairs of pores. Between *st1*, 54 μ ; between *st1* and *st3*, 105 μ . Anal shield (42 $\mu \times$ 48 μ) with par- and postanal setae about 15 μ long.

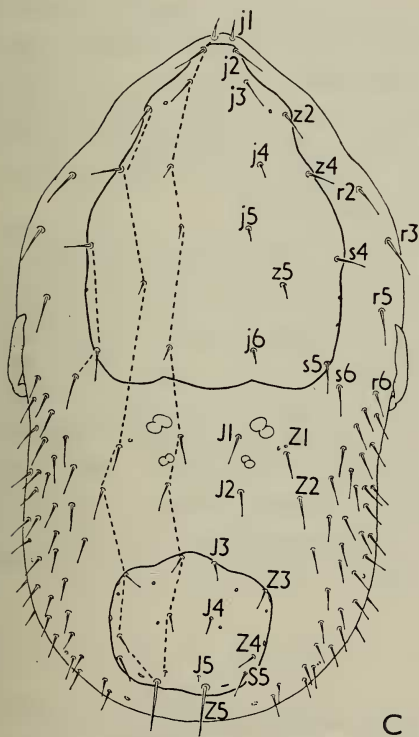
FIG. 79. A-B. *Macronyssus kolenatii* (Oudemans), protonymph; dorsum (A) and venter (B) of idiosoma. C-D. *Macronyssus flavus* (Kolenati), protonymph; dorsum (C) and venter (D) of idiosoma.



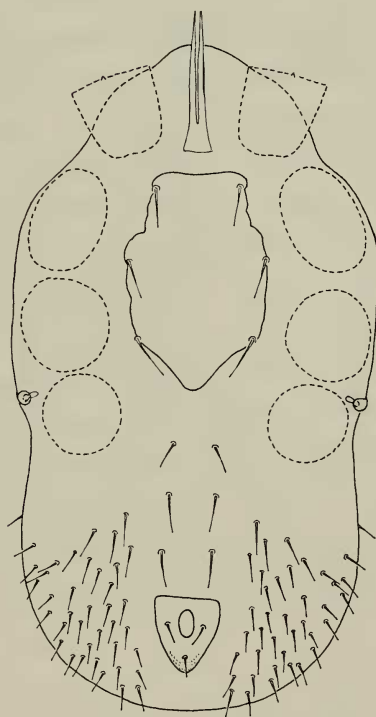
A



B



C



D

Chaetotaxy of opisthogaster as in Text-fig. 79D. Peritreme extends to about middle of coxa III.

Chaetotaxy of legs normal. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	50/50	45/50	36/45	42/40
tibia	48/45	40/48	36/42	42/40
tarsus	60/40	60/38	54/36	72/36

HABITAT : An ectoparasite of the common Noctule Bat, *Nyctalus noctula* (Schreber), in Britain and Europe.

Macronyssus kolenatii (Oudemans)

Liponyssus kolenatii Oudemans, 1902, *Ent. Ber. Amst.* **1** (8) : 48 et 1903, *Tijdschr. Ned. dierk. Vereen.* (2) **8** : 25, figs.

Liponyssus pipistrelli Oudemans, 1906, *Ent. Ber. Amst.* **2** (27) : 37 (non Oudemans, 1904).

Liponyssus cyclaspis Oudemans, 1906, *Ent. Ber. Amst.* **2** (28) : 61 (nom. nov. pro *L. pipistrelli* Oudemans, 1906) et 1915, *Arch. Naturgesch.* **81** (A) : 165, figs. 128-134.

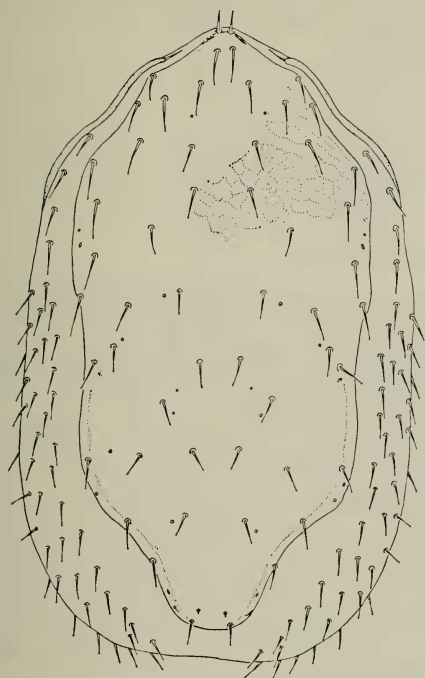
Hirstesia britteni Radford, 1953, *Parasitology* **42** : 239.

Female : Chelicera with segment I, 33 μ ; II, 130 μ ; movable digit 42 μ , distal end of dorsal hyaline flap thorn-like and usually bent at right angles to chela ; fixed digit with slender denticular processes. Pilus dentilis absent. Four pairs of gnathosomal setae with c.s. about 42 μ apart, *hyp.2* about 33 μ apart. Deutosternum with eight denticles arranged in a single file. Corniculi membranous, internal malae simple, tectum capituli tapering to an obtuse point. Pedipalp (2-5-6-14) with two-tined apotelele; palptrochanter with a conspicuous ventral keel.

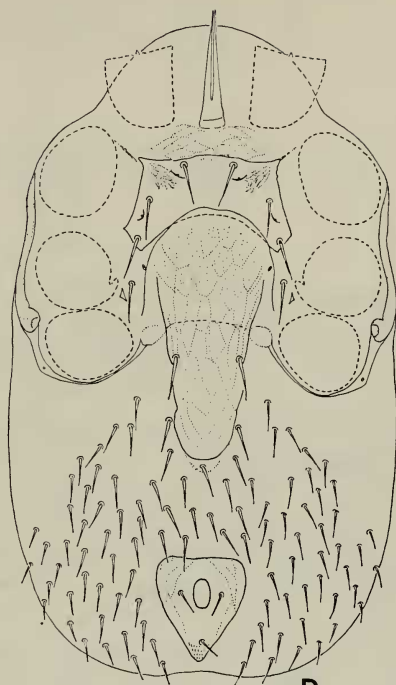
Dorsal shield (540 $\mu \times$ 252 μ) with 28 pairs of setae distributed as in Text-fig. 80A. Surface of shield reticulated. Unsclerotized integument of dorsum hypertrichous.

Tritosternum with base 21 μ , laciniae 84 μ . Presternal area reticulated. Sternal shield (57 $\mu \times$ 129 μ) with a pair of elliptical, finely striated areas in the antero-lateral corners ; with three pairs of setae and two pairs of pores ; metasternal setae free with associated pores. Between *st1*, 45 μ ; between *st1* and *st3*, 78 μ . Genital shield (90 $\mu \times$ 70 μ) reticulated, bearing a pair of genital setae and with an unpaired seta situated on a weakly sclerotized posterior extension of the shield. Anal shield (75 $\mu \times$ 75 μ) with anterior margin almost straight ; paranal setae 21 μ , postanal seta 24 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 80B. Peritremes extend to middle of coxae I ; peritrematal shields free anteriorly, fused posteriorly with podal elements of coxae IV.

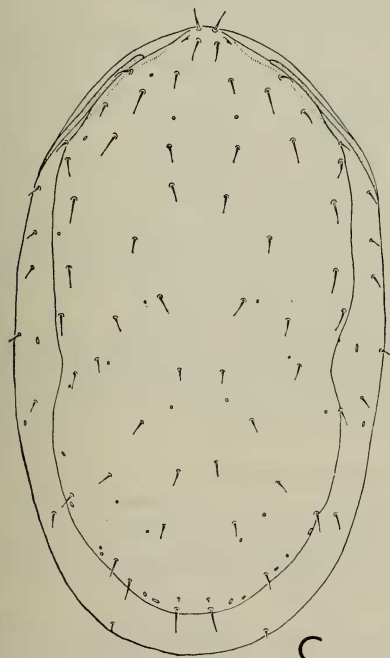
FIG. 80. *Macronyssus kolenatii* (Oudemans). A. Dorsum of idiosoma of female ; B. venter of idiosoma of female ; C. dorsum of idiosoma of male ; D. venter of idiosoma of male.



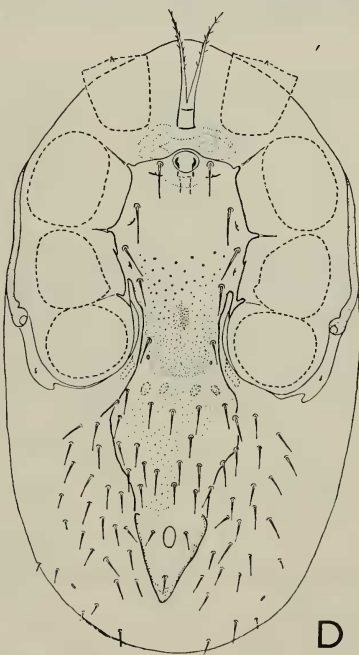
A



B



C



D

Chaetotaxy of legs normal except genu IV which has two ventral setae ($2-\frac{2}{1}$, $\frac{3}{1}-1$). Femur I with setae ad_1 and pd_1 long and stout. Coxa II with large, pointed anterior spine. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	63/48	60/54	38/45	54/45
tibia	54/45	45/50	36/42	50/42
tarsus	72/40	78/40	60/40	80/38

Male : Chelicera with segment I, 36μ ; II, 87μ ; movable digit 30μ long, edentate ; spermadactyl grooved, about 45μ long from base of movable digit. Fixed digit edentate. Four pairs of gnathosomal setae with c.s. about 40μ apart, *hyp.2* about 33μ apart. Deutosternum with 10 denticles arranged in a single file ; corniculi about 36μ long, membranous. Other gnathosomal features as in female.

Dorsal shield ($504 \mu \times 270 \mu$) with 28 or 29 pairs of setae distributed as in Text-fig. 80c. Unsclerotized integument of dorsum with seven pairs of setae.

Tritosternum with base 27μ , laciniae 90μ . Holoventral shield ($380 \mu \times 105 \mu$) with five pairs of setae in the sternito-genital region and about 20 setae in the ventral region. Between *st1*, 45μ ; between *st1* and *st3*, 81μ . Paranal and postanal setae about 18μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 80d. Peritremes extend to middle of coxae I ; peritrematal shields fused anteriorly with dorsal shield, posteriorly with podal elements of coxae IV.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	66/45	60/50	40/40	54/40
tibia	54/40	45/45	36/36	48/38
tarsus	69/33	50/36	54/33	75/34

Protonymph : Chelicera with segment I, 15μ ; II, 72μ ; movable digit 27μ . Gnathosomal features essentially as in female. Capitular setae about 30μ apart, *hyp.2* about 27μ apart. Pedipalp (1-4-5-12) with two-tined apotele.

Podonotal shield ($180 \mu \times 147 \mu$) with 10 pairs of setae as in Text-fig. 79A ; setae *j1* in front of shield. Pygidial shield ($72 \mu \times 99 \mu$) with seven pairs of setae. Two pairs of mesonotal scutellae present. Unsclerotized integument of dorsum with eleven pairs of setae (excluding *j1*).

Tritosternum with base 21μ , laciniae 54μ . Sternal shield ($110 \mu \times 75 \mu$) with three pairs of setae and two pairs of pores. Between *st1*, 42μ ; between *st1* and *st3*, 75μ . Anal shield ($36 \mu \times 39 \mu$) with par- and postanal setae about 15μ long. Opisthogaster with five pairs of setae (Text-fig. 79B). Peritremes extend to middle of coxae III.

Chaetotaxy of legs normal. Femur I with setae ad_1 and pd_1 long and thick. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	36/42	36/45	24/34	30/34
tibia	36/36	30/39	21/34	30/34
tarsus	45/30	42/30	39/27	51/27

HABITAT: An ectoparasite on bats of the genus *Pipistrellus*. Recorded from *P. pipistrellus* (Schreber) in Britain and Europe and from *P. kuhli* (Kuhl) in Egypt.

***Macronyssus uncinatus* (Canestrini)**

Leiognathus uncinatus Canestrini, 1885, *Acarofauna ital.* 1: 122; Berlese, 1889, *Acar. Myr. Scorp. Ital.* fasc. 53, no. 7.

Liponyssus rhinolophi Oudemans, 1902, *Tijdschr. Ned. dierk. Vereen.* (2) 7: 65.

Liponyssus sternalis Hirst, 1922, *Proc. zool. Soc. Lond.* (1921): 781, figs. 25-26.

Female: Chelicera with segment I, 54 μ ; II, 150 μ ; movable digit 40 μ long, truncate tip with acute dorsal angle. Fixed digit with two slender, subequal, denticular processes. Pilus dentilis absent. Four pairs of gnathosomal setae with c.s. about 63 μ apart; *hyp.2* about 45 μ apart. Deutosternum with 10-12 rows of denticles (1-4, usually one or two denticles per row). Corniculi membranous, internal malae simple. Pedipalp (2-5-6-14) with two-tined apotele; palptrochanter with conspicuous ventral keel.

Dorsal shield (798 $\mu \times$ 372 μ) with 25 pairs of setae distributed as in Text-fig. 81A. Marginal setae of podonotal region of shield conspicuously longer than setae *j4-j6* and *z5-z6*. Surface of shield granular and weakly reticulated; unsclerotized integument of opisthonotum hypertrichous.

Tritosternum with base 54 μ , laciniae 132 μ . Sternal shield (84 $\mu \times$ 180 μ) with a pair of rounded porose areas each surrounded by a heavily sclerotized margin. The shield bears three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st1*, 72 μ ; between *st1* and *st3*, 105 μ . Genital shield (150 $\mu \times$ 90 μ) with a weakly sclerotized extension of its tip bearing from one to a maximum of five opisthogastric setae. Anal shield (130 $\mu \times$ 96 μ) with paranal setae about 45 μ long, postanal seta 60 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 81B. Peritreme extends to middle of coxa I; peritrematal shield free anteriorly, posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs normal except genu IV which has two ventral setae (2— $\frac{2}{1}$, $\frac{3}{1}$ —1). Coxa II with pronounced anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	114/78	120/78	102/72	150/72
tibia	114/70	96/72	90/72	144/66
tarsus	210/60	174/60	198/63	288/60

Male and protonymph: Described by Dusbabek (1964).

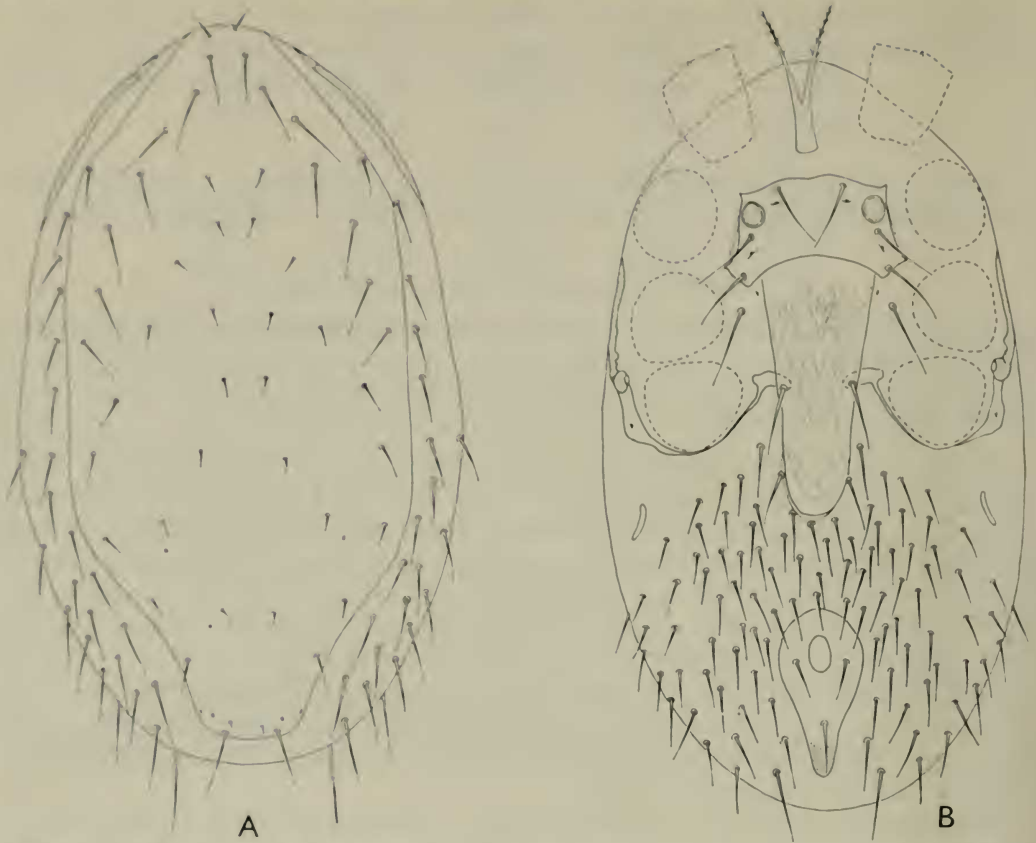


FIG. 81. *Macronyssus uncinatus* (Canestrini), female; dorsum (A) and venter (B) of idiosoma.

HABITAT: An ectoparasite of bats. Reported from *Rhinolophus hipposideros* (Bechstein) in Britain and from *R. ferrumequinum* (Schreber), *R. euryale* Blasius, *Pipistrellus pipistrellus* (Schreber), *Myotis emarginatus* (Geoffroy) and *Miniopterus schreibersi* (Natterer) in Europe.

Genus *ORNITHONYSSUS* Sambon

Leiognathus Canestrini, 1884, *Atti ist. Veneto* (6) 2: 1573 (nom. preocc.).

Ornithonyssus Sambon, 1928, *Ann. trop. Med. Parasit.* 22: 105.

Bdellonyssus Fonseca, 1941, *Cienca* 2: 262.

Fonsecaonyssus Radford, 1950, *Parasitology* 40: 373.

Type: *Dermanyssus sylviarum* Canestrini and Fanzago, 1877.

Chelicerae chelate, edentate, without denticular processes; fixed digit in the female terminating in a hyaline boss. Spermadactyl grooved, free distally, relatively short. Pilus dentilis absent, dorsal seta minute, fissures present. Arthrodistal

processes absent. Chaetotaxy of venter of gnathosoma normal, pedipalps with five free segments and a two-tined apotele. Chaetotaxy of palptrochanter to tibia (2-5-6-13), rarely (2-5-6-12). Seta *pl* on palpfemur of male usually situated on a tubercle. Palptrochanter usually with an antero-ventral keel in the females, rarely in the males. Deutosternum with 9-11 denticles arranged in a single file. Corniculi membranous, internal malae simple, free or fused. Tectum elongate, tapering to an obtuse or acute point, lateral margins smooth or weakly denticulate.

Dorsal idiosomal sclerotization reduced in the female and normally comprising an entire dorsal shield strongly tapering behind the level of *j*6 and *z*6, rarely with podonotal shield bearing ten pairs of podonotal setae and one pair of opisthonotal setae (*J*1), and a separate pygidial shield with two pairs of setae (*O. aridus*). Podonotal region with 10-12 pairs of setae, *j*3 present or absent. Opisthonotal region with 6-11 pairs of setae, *J*5 present or absent. Lateral cuticle hypertrichous. Dorsal idiosomal sclerotization in the male more extensive, podonotal region with 10-14 pairs of setae, opisthonotal region with 7-11 pairs. Lateral cuticle less setose than in the female. Dorsal setae smooth or sparsely barbed.

Tritosternum bipartite with hyaline denticulate border. Sternal shield normally with three pairs of setae and two pairs of pores, rarely with two pairs of setae and two pairs of pores (*O. sylviarum*). Genital shield strongly tapering posteriorly with genital setae only. Anal shield normal. Metapodals poorly developed. Opisthogastric cuticle shows hypertrichy. Peritrematal shield fused with podals of coxae IV, free anteriorly. Podal shields weakly developed. Males with slender holoventral shield. Peritrematal shield free or fused anteriorly with the dorsal shield.

Chaetotaxy of legs normal except genu III ($2-\frac{2}{1}, \frac{2}{1}-2$), tibia III ($2-\frac{1}{1}, \frac{2}{1}-2$) and genu IV ($2-\frac{2}{1}, \frac{3}{1}-1$). Rarely genu and tibia I with two ventrals only and genua II and III with one ventral in some populations of *O. sylviarum*. Coxa II with anterior spine sometimes minute. Coxa III with retrograde spur only in *O. pereira*; no sclerotized ridges.

Protonymph with dorsum of idiosoma provided with a podonotal shield bearing 10 (*j*3 lacking) or 11 pairs of setae, two or more pairs of mesonotal scutellae, and a pygidial shield bearing from three to six pairs of setae. The unsclerotized integument of the dorsum usually bears 15 or 16 pairs of setae. Venter with three pairs of sternal setae, one pair of genital and four to five pairs of opisthogastric setae. Anal shield with normal chaetotaxy. Gnathosoma essentially as in female. Chaetotaxy of legs and pedipalps normal. Palptrochanter with or without ventral keel.

The above concept of *Ornithonyssus* is considerably wider than that of Furman & Radovsky (1963). These authors restrict this genus to New World forms, except for four species, *O. bacoti*, *ondatrae*, *sylviarum* and *bursa*, "which have been widely dispersed by human activity". They correctly point out that the species included in their concept of *Ornithonyssus* differ from Old World forms in both sexes having certain idiosomal setae, particularly the caudal and marginal setae, barbed and seta *pl* on the palpfemur of the male situated on a tubercle. It is possible that the New and Old World species of *Ornithonyssus* s. lat. are not congeneric but their status must await a comprehensive revision of the complex.

KEY TO FEMALES

- 1 Dorsal shield with setae j_3 present ; opisthonotal region of shield with eight pairs of setae. Dorsal setae smooth. Peritremes extend to middle of coxae II. First pair of sternal setae about half as long as the second. On bats (*Eptesicus* and *Plecotus*) ***O. pipistrelli*** (Oudemans) (p. 326)
- Dorsal shield with setae j_3 absent ; opisthonotal region of shield with not more than seven pairs of setae. Some dorsal setae barbed. Peritremes extend to posterior margin of coxae I. Sternal setae subequal 2
- 2 Dorsum with setae s_4 and S_5 situated on the shield ; setae of J series relatively long, J_1 reaching base of J_2 (Text-fig. 83A). Sternal shield with three pairs of setae. Opisthogastric cuticle relatively densely setose (Text-fig. 83D). Palptibia with 13 setae. On small mammals ***O. bacoti*** (Hirst) (p. 321)
- Dorsum with setae s_4 and S_5 not on the shield ; setae of J series relatively short, J_1 extending less than half way to base of J_2 (Text-fig. 82A). Sternal shield with two pairs of setae. Opisthogastric cuticle relatively sparsely setose (Text-fig. 82B). Palptibia with 12 setae. On birds ***O. sylviarum*** (Canestrini & Fanzago) (p. 318)

KEY TO MALES

- 1 Dorsal shield with 14 pairs of setae in the podonotal region. Coxae II and III with anterior setae stout and spine-like. Palpfemur with seta pl normal, not situated on a tubercle. On bats (*Eptesicus* and *Plecotus*) ***O. pipistrelli*** (Oudemans) (p. 326)
- Dorsal shield with 10 or 11 pairs of setae in podonotal region. Coxae II and III with anterior setae normal. Palpfemur with seta pl situated on a tubercle 2
- 2 Dorsum with seta S_5 on shield. Setae of j series relatively long, seta j_4 reaching base of j_5 . Holoventral shield with eight pairs of setae, excluding anals. Palptibia with 13 setae. On small mammals ***O. bacoti*** (Hirst) (p. 323)
- Dorsum with seta S_5 not on the shield. Setae of the j series relatively short, seta j_4 reaching half-way to base of j_5 . Holoventral shield with six pairs of setae, excluding anals. Palptibia with 12 setae. On birds ***O. sylviarum*** (Canestrini & Fanzago) (p. 320)

Ornithonyssus sylviarum (Canestrini & Fanzago)

Dermanyssus sylviarum Canestrini & Fanzago, 1877, *Atti Ist. Veneto* 5 : 124.

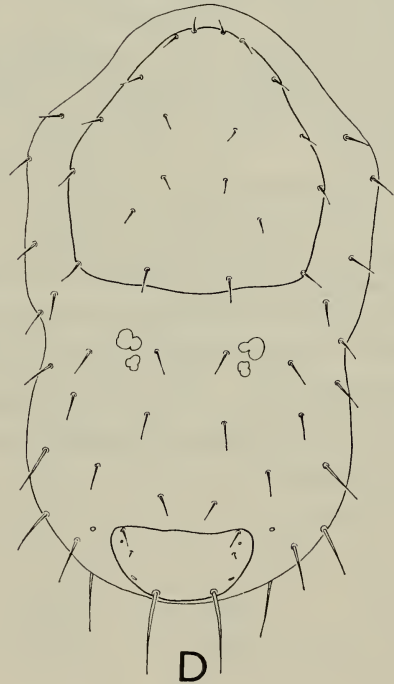
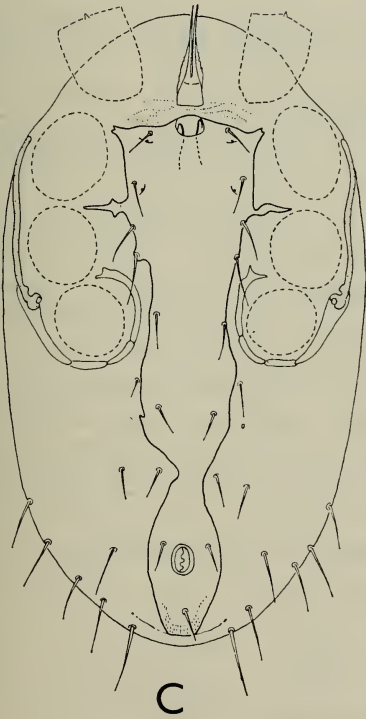
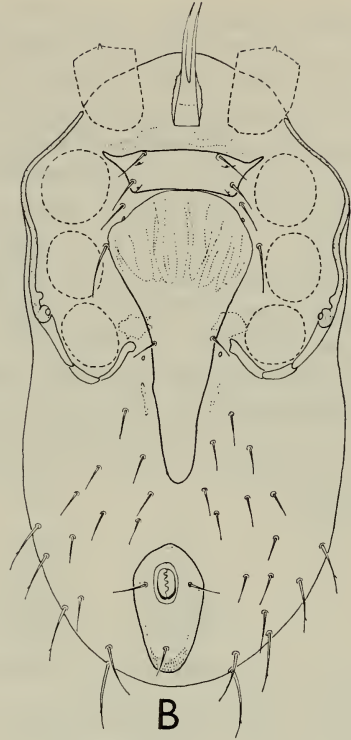
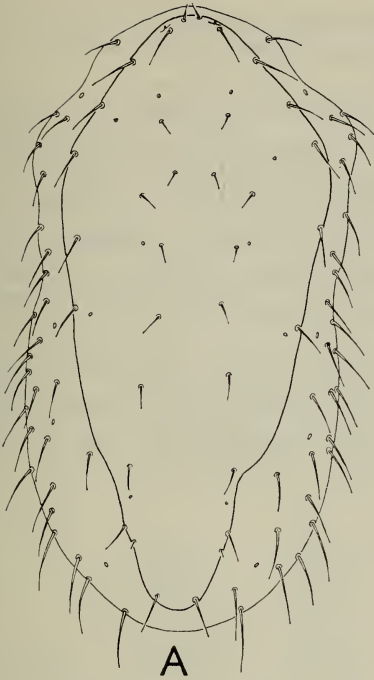
Liponyssus americanus Banks, 1906, *Proc. ent. Soc. Wash.* 8 : 136.

Liponyssus canadensis Banks, 1909, *Proc. ent. Soc. Wash.* 11 : 134.

Liponyssus pacificus Ewing, 1923, *Proc. U.S. nat. Mus.* 62 (art. 13) : 19.

Female : Chelicera with segment I, 20 μ ; II, 150 μ ; movable digit 36 μ long, with a dorsal "trough" ; both digits edentate ; pilus dentilis and arthrodial processes absent. Four pairs of gnathosomal setae with c.s. about 50 μ apart, *hyp.* 2 about 36 μ apart. Deutosternum with about 10 denticles arranged in a single file. Corniculi membranous ; internal malae with inner processes fused, outer leaf-like. Tectum capituli tapers to a sharp point, margin weakly denticulate. Pedipalp (2-5-6-12) with two-tined apotele ; palptrochanter with small ventral keel.

FIG. 82. *Ornithonyssus sylviarum* (Canestrini and Fanzago). A. Dorsum of idiosoma of female ; B. venter of idiosoma of female ; C. venter of idiosoma of male ; D. dorsum of idiosoma of protonymph.



Dorsal shield ($534 \mu \times 228 \mu$) usually with 17 pairs of setae distributed as in Text-fig. 82A; one or more of the setae in the opisthonotal region may be absent. Unsclerotized integument of dorsum hypertrichous.

Tritosternum with hyaline denticulate membrane, base 42μ , laciniae 75μ . Sternal shield ($36 \mu \times 100 \mu$) reticulated and bearing two pairs of setae and two pairs of pores; *st*3 and *st*4 on unsclerotized cuticle. Between *st*1, 66μ ; between *st*1 and *st*3, 52μ . Genital shield ($132 \mu \times 60 \mu$) tapering, with genital setae only. Anal shield ($96 \mu \times 66 \mu$) with par- and postanal setae subequal, about 30μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 82B. Peritremes extend to posterior margin of coxae I; peritrematal shields free anteriorly, fused posteriorly with podal elements of coxae IV.

Chaetotaxy of legs generally normal except genu III ($2-\frac{2}{1}, \frac{2}{0/1}-2$), tibia III ($2-\frac{1}{1}, \frac{2}{1}-2$) and genu IV ($2-\frac{2}{1}, \frac{3}{1}-1$). In addition, one of the ventral setae may be lacking on genu I ($2-\frac{3}{1/2}, \frac{3}{1}-2$), tibia I ($2-\frac{3}{1/2}, \frac{3}{1}-2$) and genu II ($2-\frac{3}{1}, \frac{2}{0/1}-2$) in some specimens. Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	60/38	54/45	48/36	60/33
tibia	60/34	50/38	48/33	63/33
tarsus	110/34	90/36	96/30	130/30

Male: Chelicera with segment I, 20μ ; II, 90μ ; movable digit 27μ long; both digits edentate; spermadactyl 36μ long from base of movable digit. Four pairs of gnathosomal setae with *c.s.* about 50μ apart, *hyp.2* about 36μ apart. Deutosternum with ten denticles arranged in a single file. Corniculi membranous; internal malae blade-like. Palptrochanter without a ventral keel. Other gnathosomal features as in female.

Dorsal shield ($444 \mu \times 210 \mu$) with chaetotaxy as in female, except that it may incorporate one or more marginal setae in the opisthonotal region. The short posterolateral seta (*x*) varies in position; it may be posterior to seta *Z*₄ as in the female, level with it or anterior to it. Unsclerotized integument of dorsum hypertrichous.

Tritosternum with base 24μ , laciniae 57μ . Holovenal shield ($360 \mu \times 93 \mu$) narrow, with six pairs of setae excluding the anals. Between *st*1, 54μ ; between *st*1 and *st*3, 70μ . Par- and postanal setae subequal, about 24μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 82c. Peritreme extends to middle of coxa II; peritrematal shields free anteriorly, fused posteriorly with podal shields of coxae IV.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	46/32	45/38	40/33	54/30
tibia	48/30	42/33	38/27	52/28
tarsus	87/27	75/30	75/27	102/27

Protonymph: Chelicera with segment I, 15 μ ; II, 105 μ ; movable digit 27 μ . Gnathosomal features generally as in female. Four pairs of gnathosomal setae with c.s. about 45 μ apart, *hyp.2* about 30 μ apart. Deutosternum with 8 denticles arranged in a single file. Pedipalp (1-4-5-12) with two-tined apotele.

Podonotal shield (162-174 $\mu \times$ 144-156 μ) with ten pairs of setae distributed as in Text-fig. 82D. Pygidial shield (50 $\mu \times$ 100 μ) with three pairs of setae, the terminal pair (Z5) being at least four times as long as the other setae on the shield. Un-sclerotized integument of dorsum with 16 pairs of setae.

Tritosternum with base 24 μ , laciniae 60 μ . Sternal shield (120 $\mu \times$ 96 μ) with three pairs of setae and two pairs of pores. Between *st1*, 63 μ ; between *st1* and *st3*, 75 μ . Genital setae very short, about half as long as the sternal and the four pairs of opisthogastric setae. Anal shield (42-45 $\mu \times$ 50-54 μ) with paranal setae about 24 μ , postanal seta about 18 μ long. Peritreme extends to posterior third of coxa III.

Chaetotaxy of legs normal. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	40/36	36/36	32/32	40/30
tibia	42/33	33/33	30/30	42/30
tarsus	78/30	57/27	63/27	84/26

HABITAT: A common parasite of poultry and wild birds in Britain, Europe, U.S.S.R. and North America. It has also been recorded from a number of wild birds in South Africa (Zumpt & Till, 1961).

Ornithonyssus bacoti (Hirst)

Leio gnathus bacoti Hirst, 1913, *Bull. ent. Res.* 4: 122 et 1914, *Bull. ent. Res.* 5: 225, figs. 12-14.

Haemogamasus sanguineus Ewing & Stover, 1915, *Ent. News* 26: 109.

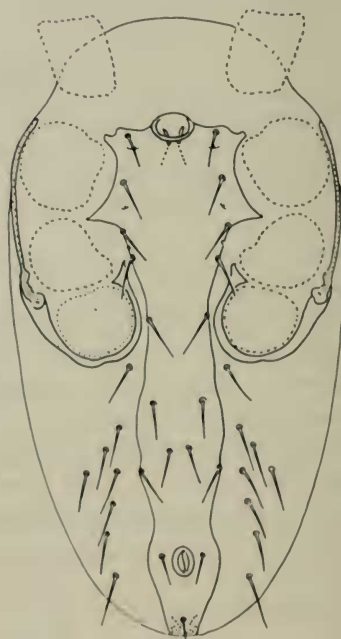
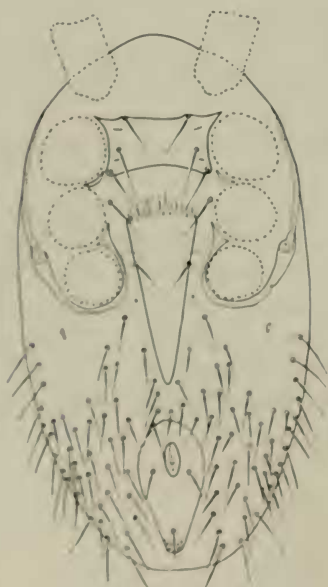
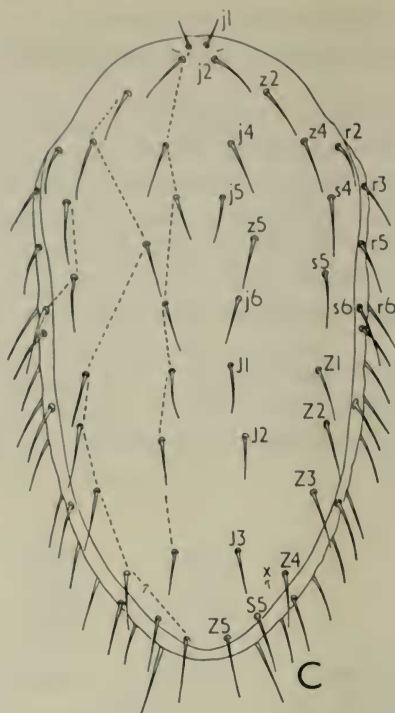
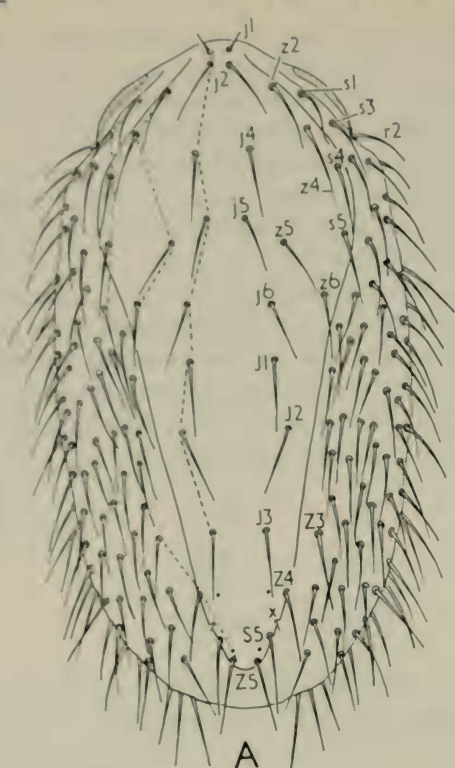
Liponyssus tenuisculatus Ewing, 1923, *Proc. U.S. nat. Mus.* 62 (art. 13): 22.

Liponyssus nagayoi Yamada, 1930, *Proc. eighth Congr. Far East Ass. trop. Med.* 2: 258.

Female: Chelicera with segment I, 33 μ ; II, 228 μ ; movable digit 50 μ long, with an elliptical "trough" in its dorsal surface. Fixed digit slender, terminating in a hyaline boss. Pilus dentilis and arthroal processes absent (Text-fig. 83E). Four pairs of gnathosomal setae with c.s. about 57 μ apart, *hyp.2* about 42 μ apart. Deutosternum with about ten denticles arranged in a single file. Corniculi membranous; internal malae fused. Tectum capituli tapering to a point. Pedipalp (2-5-6-13) with two-tined apotele; palptrochanter with an antero-ventral keel.

Dorsal shield (660 $\mu \times$ 198 μ) with 18 pairs of setae distributed as in Text-fig. 83A. Un-sclerotized integument of dorsum hypertrichous.

Tritosternum with hyaline denticulate membrane; base 66 μ , laciniae 108 μ . Sternal shield (50 $\mu \times$ 120 μ) reticulated, with three pairs of setae and two pairs of pores; metasternals free. Between *st1*, 70 μ ; between *st1* and *st3*, 66 μ . Genital shield (174-180 $\mu \times$ 70-75 μ) tapering, with genital setae only. Anal shield (123-135 $\mu \times$ 78-87 μ) with paranal setae 42 μ , postanal seta 45 μ long. Chaetotaxy and



D

F

sclerotization of opisthogaster as in Text-fig. 83D. Peritreme extends to posterior margin of coxa I; peritrematal shield free anteriorly, posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs normal except genu III ($2-\frac{2}{1}$, $\frac{2}{1}-2$), tibia III ($2-\frac{1}{1}$, $\frac{2}{1}-2$) and genu IV ($2-\frac{2}{1}$, $\frac{3}{1}-1$). Coxa II with small anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	96/40	66/45	60/42	84/38
tibia	96/33	66/42	60/40	84/33
tarsus	162/33	120/36	126/34	168/33

Male: Chelicera with segment I, 27 μ ; II, 120 μ ; movable digit 36 μ ; both digits edentate. Spermadactyl relatively short, 45 μ from base of movable digit (Text-fig. 83B). Dorsal seta minute, pilus dentilis and arthrodial processes absent. Four pairs of gnathosomal setae with c.s. about 54 μ apart, *hyp*.2 about 38 μ apart. Corniculi membranous; internal malae blade-like, free. Pedipalp as in female, but palptrochanter without ventral keel; seta *pl* on palpfemur situated on a small tubercle.

Dorsal shield (528 $\mu \times$ 270 μ) with 21 pairs of setae distributed as in Text-fig. 83C. Unsclerotized integument of dorsum much less densely setose than in the female.

Tritosternum with base 36 μ , laciniae 75 μ . Holoventral shield (444 $\mu \times$ 100 μ) narrow, with eight pairs of setae excluding the anals. Paranal setae 30 μ , postanal seta 33 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 83F. Peritremes extend to posterior margin of coxae I; peritrematal shields fused anteriorly with dorsal shield and posteriorly with podal elements of coxae IV.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	75/40	60/48	60/45	72/36
tibia	78/33	54/48	54/42	75/36
tarsus	130/30	80/40	87/34	120/30

Larva: Chelicera with segment I, 10 μ ; II, 63 μ ; movable digit 8 μ ; both digits simple and edentate. Two pairs of gnathosomal setae (*hyp*.1 and 2) with *hyp*.2 about 24 μ apart. Deutosternal teeth not visible. Corniculi degenerate. Pedipalp (0-3/4-5-10) with two-tined apotele; palptrochanter without keel.

Dorsum with no visible sclerotization; with eight pairs of setae in the podonotal region and three pairs in the opisthonotal region.

Tritosternum bipartite, laciniae strongly reduced, without visible denticulate membrane; base 36 μ , laciniae 24 μ . Sternal region with three pairs of setae, but

FIG. 83. *Ornithonyssus bacoti* (Hirst). A. Dorsum of idiosoma of female; B. chelicera of male; C. dorsum of idiosoma of male; D. venter of idiosoma of female; E. chelicera of female; F. venter of idiosoma of male.

no visible sclerotization. Opisthogaster with two pairs of setae (*Jv1* and *Jv2*); three anal setae present, but no definite shield. Stigma and peritreme absent. Chaetotaxy of legs as in free-living Dermanyssidae.

Protonymph: Chelicera with segment I, 24 μ ; II, 135 μ ; movable digit 33 μ . Gnathosomal features generally as in female. Four pairs of gnathosomal setae with c.s. about 36 μ apart, *hyp.2* about 27 μ apart. Deutosternum with nine denticles arranged in a single file. Pedipalp (1-4-5-12) with two-tined apotele, no keel on palptrochanter.

Podonotal shield (228 $\mu \times 174 \mu$) with ten pairs of setae as in Text-fig. 84A; pygidial shield (75 $\mu \times 123 \mu$) with four pairs of setae. Unsclerotized integument of dorsum with 16 pairs of setae.

Tritosternum bipartite, with hyaline denticulate membrane; base 27 μ , laciniae 75 μ . Sternal shield (123 $\mu \times 90 \mu$) with three pairs of setae and two pairs of pores. Between *st1*, 50 μ ; between *st1* and *st3*, 90 μ . A pair of short genital setae is situated posterior to the sternal shield. Anal shield (60 $\mu \times 42 \mu$) with paranal setae 30 μ ; postanal seta 36 μ long. Opisthogastric cuticle with four pairs of setae, *Jv1-2*, *Jv5* and *Zv2* (Text-fig. 84B). Peritreme extends to anterior margin of coxa III.

Chaetotaxy of legs normal. Length/width (in μ) of leg segments:

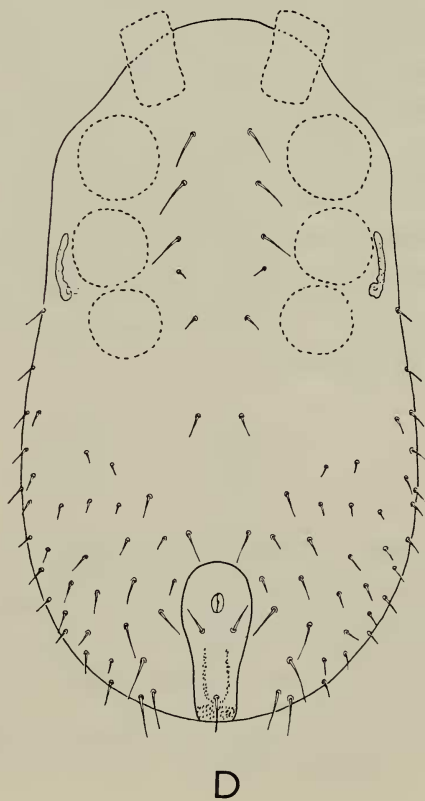
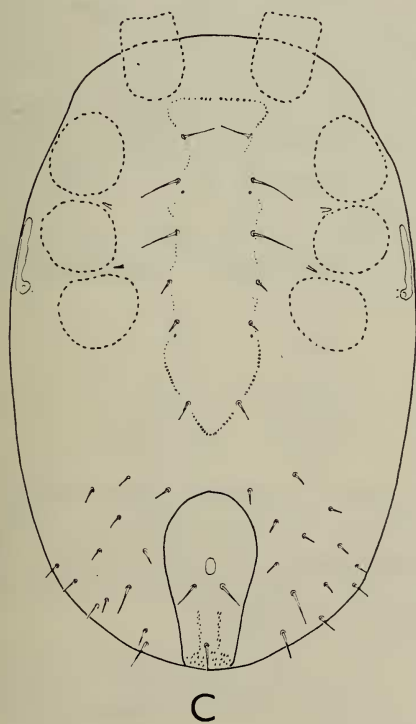
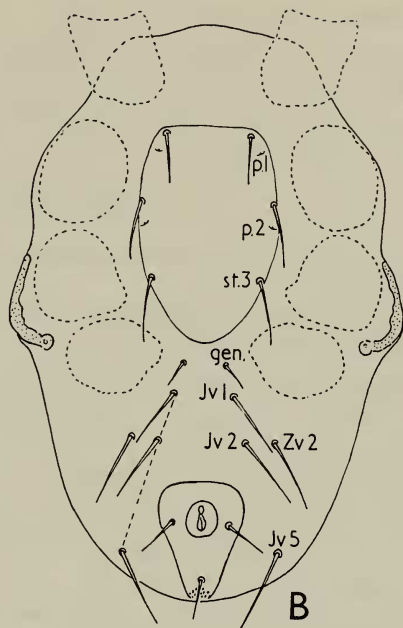
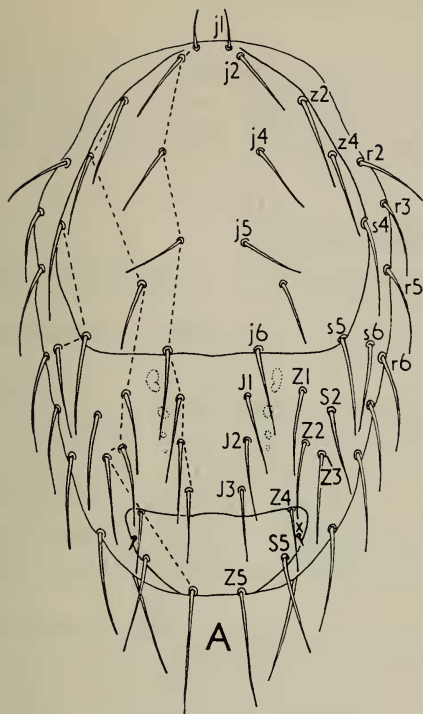
	I	II	III	IV
genu	48/33	42/39	33/33	45/33
tibia	54/30	40/36	33/33	48/30
tarsus	93/27	60/30	60/27	84/27

Deutonymph: Male and female deutonymphs have been distinguished which differ chiefly in their setation, the female being more densely hypertrichous than the male. In both forms the chelicerae have simple edentate digits as in the larva. Deutosternum with ten transverse rows of denticles (one to three denticles per row); internal malae not fused; pedipalp (2-5-6-13) with two-tined apotele.

Dorsum very weakly sclerotized, so that distinct shields are not recognizable. Male with 15 pairs of setae in the podonotal and 22 pairs in the opisthonotal region; female with 23 pairs of setae in the podonotal region, opisthonotal region markedly hypertrichous.

Tritosternum simple, bipartite only at its tip. Area between the coxae with three pairs of relatively long sternal setae, a pair of short metasternal and a pair of short genital setae. The margins of a shield are weakly defined in the male (Text-fig. 84c), but not visible in the female (Text-fig. 84d). Opisthogastric cuticle with 13 pairs of setae in the male, markedly hypertrichous in the female. Par- and postanal setae subequal in length. Peritremes extend to anterior margin of coxae III.

FIG. 84. *Ornithonyssus bacoti* (Hirst). A. Dorsum of idiosoma of protonymph; B. venter of idiosoma of protonymph; C. venter of idiosoma of deutonymph (male); D. venter of idiosoma of deutonymph (female).



Chaetotaxy of legs as in female.

HABITAT: *O. bacoti*, the tropical rat mite, is apparently of recent introduction to Britain where its distribution is centred mainly around ports. It is essentially a parasite of rodents, especially *Rattus rattus* (Linn.), but is also known to bite man (Evans *et al.*, 1961).

***Ornithonyssus pipistrelli* (Oudemans)**

Liponyssus musculi (Koch) Oudemans, 1902, *Tijdschr. Ned. dierk Vereen.* (2) 8: 17, pl. 1, figs. 1-2.

Liponyssus pipistrelli Oudemans, 1903, *Tijdschr. Ent.* 46: 111 [nom. nov. pro *Liponyssus musculi* (Koch) Oudemans, 1902].

Female: Chelicera with segment I, 54 μ ; II, 174 μ ; movable digit 50 μ , edentate with dorsal "trough"; fixed digit with terminal hyaline boss. Four pairs of gnathosomal setae with c.s. about 66 μ apart, *hyp*.2 about 42 μ apart. Deutosternum with nine denticles arranged in a single file. Corniculi membranous; internal malae with inner processes fused, outer large and leaf-like. Tectum capituli tapering, with serrated margin. Pedipalp (2-5-6-13) with two-tined apotele; palp-trochanter with ventral keel.

Dorsal shield (912 μ $\times$ 294 μ) narrow, reticulated, with 20 pairs of setae distributed as in Text-fig. 85A. Unsclerotized integument of dorsum hypertrichous.

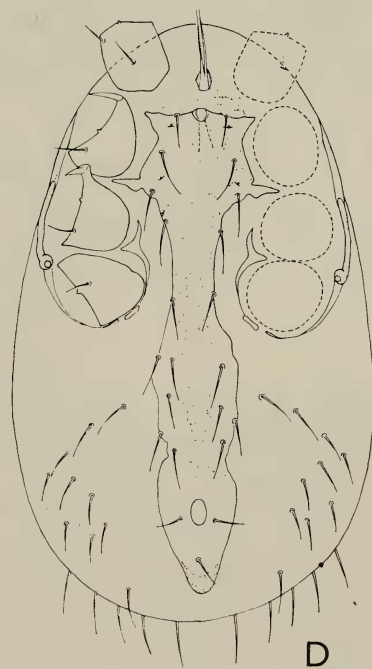
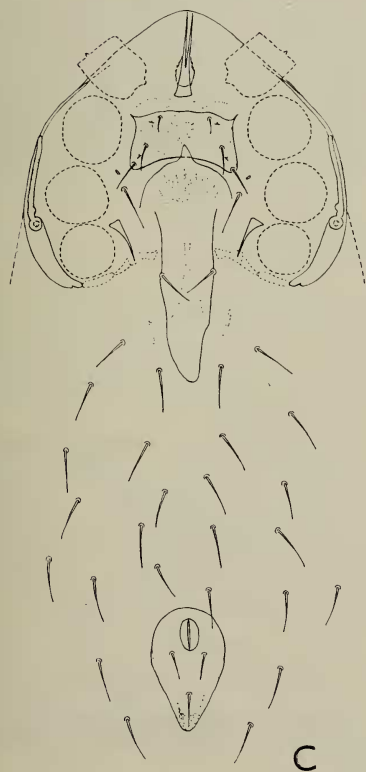
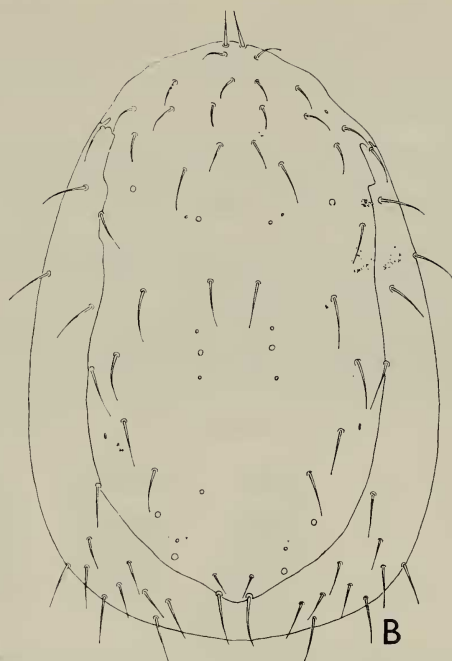
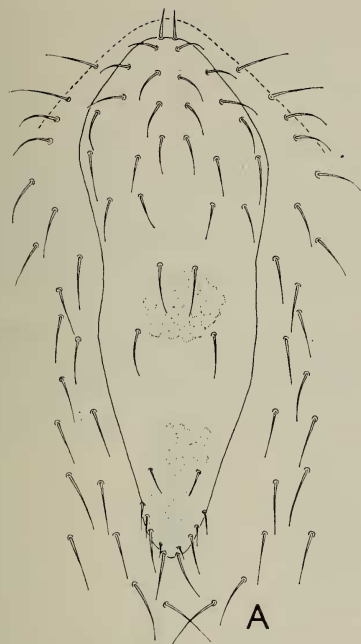
Tritosternum with denticulate hyaline border; base 54 μ , laciniae 110 μ . Sternal shield (75 μ $\times$ 144 μ) reticulated, with three pairs of setae and two pairs of pores; metasternals free with associated pores. Between *st*1, 87 μ ; between *st*1 and *st*3, 93 μ . Genital shield (180 μ $\times$ 90 μ) tapering, with genital setae only. Anal shield (75 μ $\times$ 63 μ) with paranal setae 18 μ , postanal seta 27 μ . Integument of opisthogaster hypertrichous (Text-fig. 85C). Peritreme extends to middle of coxa II. Anterior part of peritrematal shield extends to middle of coxa I, ending freely; posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs normal except genu III (2— $\frac{2}{1}$, $\frac{2}{1}$ —2), tibia III (2— $\frac{1}{1}$, $\frac{2}{1}$ —2) and genu IV (2— $\frac{2}{1}$, $\frac{3}{1}$ —1). Coxa II with prominent anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	144/54	117/66	114/66	150/60
tibia	144/51	114/63	114/60	150/54
tarsus	258/48	192/54	174/48	240/54

Male: Chelicera with segment I, 36 μ ; II, 126 μ ; movable digit edentate, 42 μ long; spermadactyl relatively short, 54 μ from base of movable digit. Four pairs of gnathosomal setae with c.s. about 51 μ apart, *hyp*.2 about 39 μ apart. Deutosternum with ten denticles arranged in a single file. Corniculi membranous, internal malae leaf-like. Tectum capituli and pedipalps as in female.

FIG. 85. *Ornithonyssus pipistrelli* (Oudemans). A. Dorsal shield of female; B. dorsum of idiosoma of male; C. venter of idiosoma of female; D. venter of idiosoma of male.



Dorsal shield ($696\ \mu \times 360\ \mu$) considerably broader than in the female, covering almost the entire dorsum (Text-fig. 85B); bearing about 25 pairs of setae. Surface of shield strongly reticulated; unsclerotized integument of dorsum with about 12 pairs of setae.

Tritosternum with base $30\ \mu$, laciniae $78\ \mu$. Holoventral shield ($588\ \mu \times 123\ \mu$) narrow, reticulated, with 19 setae excluding the anals. Between *st*1, $70\ \mu$; between *st*1 and *st*3, $100\ \mu$. Paranal setae about $33\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 85D. Peritreme extends to anterior margin of coxa III; anterior part of peritrematal shield fused with dorsal shield, posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs as in female. Coxa II with prominent anterior spine. Anterior setae on coxae II and III large and spine-like. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	120/48	96/60	99/57	132/57
tibia	126/48	84/57	93/54	126/54
tarsus	204/42	126/48	126/45	192/45

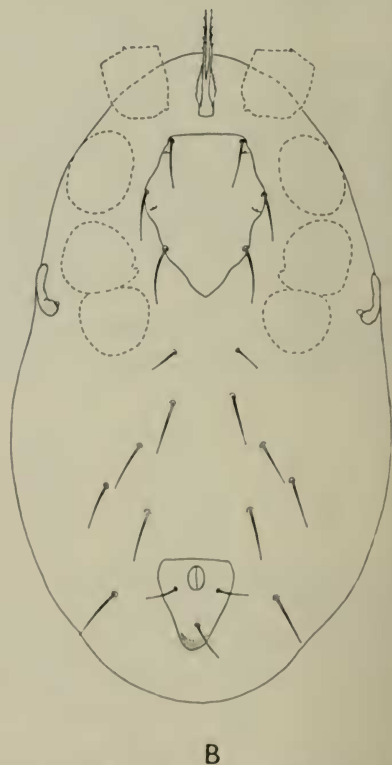
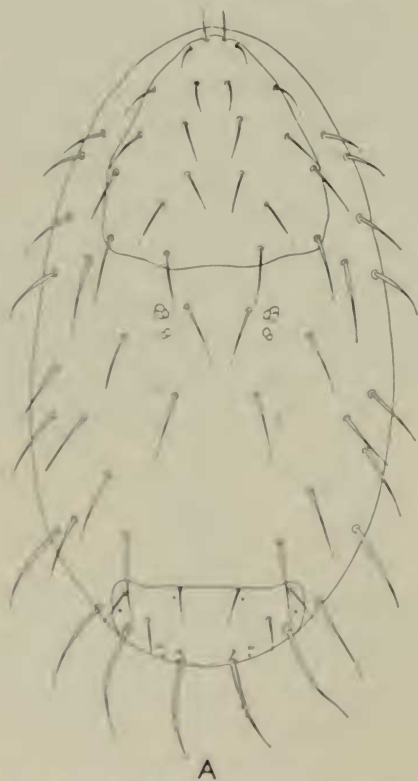


FIG. 86. *Ornithonyssus pipistrelli* (Oudemans), protonymph; dorsum (A) and venter (B) of idiosoma.

Protonymph: Chelicera with segment I, 30 μ ; II, 99 μ ; movable digit 30 μ . Gnathosomal features essentially as in female. Four pairs of gnathosomal setae with c.s. about 42 μ apart, *hyp.2* about 30 μ apart. Deutosternum with nine denticles arranged in a single file. Pedipalp (1-4-5-12) with two-tined apotele; palptrochanter with small ventral keel.

Podonotal shield (210 $\mu \times$ 204 μ) with 11 pairs of setae (Text-fig. 86A); pygidial shield (66 $\mu \times$ 180 μ) very broad, with six pairs of setae. Unsclerotized integument of dorsum with about 15 pairs of setae.

Tritosternum with base 36 μ , laciniae 45 μ . Sternal shield (150 $\mu \times$ 117 μ) with three pairs of setae and two pairs of pores. Between *st1*, 66 μ ; between *st1* and *st3*, 96 μ . Anal shield (60-63 $\mu \times$ 66-69 μ) with paranal setae about 30 μ , postanal seta about 36 μ long. Opisthogaster with a pair of genital and five pairs of opisthogastric setae distributed as in Text-fig. 86B. Peritreme extends to posterior third of coxa III.

Chaetotaxy of legs normal. Length / width(in μ) of leg segments:

	I	II	III	IV
genu	63/39	54/45	48/40	60/36
tibia	63/36	54/42	51/38	60/33
tarsus	117/33	87/33	84/32	110/30

HABITAT: Found in Dorset, England, on *Eptesicus serotinus* (Schreber) and *Plecotus auritus* (Linn.). Oudemans described the species from "*Vespertilio pipistrellus*", but does not give any locality. Lange (1959) describes a closely related species (*O. pavlovskii*) from *Muscardinus avellanarius* (Linn.) in Rumania. The number and relative positions of the setae on the dorsal shield of the female appear to be identical with the condition in *O. pipistrelli*.

Genus *STEATONYSSUS* Kolenati

Steatonyssus Kolenati, 1858, *Wien. ent. Monatschr.* 2: 6; et 1859, *S.B. Akad. Wiss. Wien.* 35: 186.

Till & Evans, 1964, *Bull. Brit. Mus. (nat. Hist.) Zool.* 11: 513.

Ceratonyssus Ewing, 1923, *Proc. U.S. nat. Mus.* 62 (art. 13): 6.

Type: *Steatonyssus periblepharus* Kolenati, 1858.

Cheliceral digits edentate, lacking denticulate processes; fixed digit with distal hyaline boss. Movable digit of male not hooked distally; spermadactyl grooved, relatively short, a membranous lobe present between spermadactyl and digit. Pilus dentilis absent, dorsal seta minute or absent, fissures normal. Arthrodial processes absent. Chaetotaxy of venter of gnathosoma normal; pedipalps with five free segments and a two-tined apotele; chaetotaxy of trochanter to tibia (2-5-6-13). Palptrochanter with well-developed keel in the female. Deutosternum with six to ten denticles arranged in a single file. Corniculi membranous, internal malae simple. Tectum capituli elongate, apex fimbriated.

Dorsal sclerotization of the female comprising well-developed podonotal and opisthonotal shields. Podonotal shield with ten (j_3 lacking), 11 or 13 pairs of setae, paravericals (z_1) absent. Opisthonotal shield normally with seven pairs of setae, but this number may be reduced by the absence of J_5 or J_5 and Z_5 . Unpaired accessory setae sometimes present in the J region. Lateral integument hypertrichous. Male with entire dorsal shield; podonotal region with 11 or 12 pairs of setae; opisthonotal region with similar chaetotaxy to the opisthonotal shield of the female, but with a tendency for the addition of Z and S setae to the shield.

Tritosternum normal, bipartite, with hyaline denticulate border. Sternal shield with three pairs of setae and two pairs of pores; posterior margin often with a more strongly sclerotized band. Genital shield tapering posteriorly, with genital setae only. Anal shield normal. Opisthogastric cuticle usually shows hypertrichy. Metapodal shields weak. Peritrematal shields fused with podal shields of coxae IV. Male with holoventral shield.

Leg chaetotaxy typically—leg I normal, leg II normal, leg III normal except genu III ($2-\frac{2}{1}, \frac{2}{1}-2$) and tibia III ($2-\frac{1}{1}, \frac{2}{1}-2$) and leg IV normal except genu IV ($2-\frac{2}{1}, \frac{3}{1}-1$). Other exceptions occurring rarely are tibia I ($2-\frac{3}{2}, \frac{2}{1}-2$), tibia III ($2-\frac{2}{1}, \frac{3}{1}-2$) and tibia IV ($2-\frac{2}{1}, \frac{3}{1}-2$). Coxa II with strong anterior spine in both sexes.

Protonymph with dorsum of idiosoma bearing 28 (j_2 lacking) or 29 pairs of setae. Podonotal shield with 10 or 11 pairs of setae, pygidial shield normally with four pairs. According to chaetotactic patterns of certain adults whose protonymphs have not been found, it is possible that the number of dorsal setae may be reduced to 26 (j_2, J_5 and Z_5 lacking) or 28 (J_5 missing). Venter of idiosoma with three pairs of sternal setae, one pair of genital setae and five pairs of opisthogastric setae. Anal shield normal. Gnathosoma as in female, but palptrochanter lacking ventral keel. Chaetotaxy of palps and legs normal.

KEY TO FEMALES

- 1 Sternal setae 1 very short, not more than one-half the length of sternal setae 2 (Text-fig. 87B); peritrematal shield entire anteriorly *S. periblepharus* Kolenati (p. 330)
- Sternal setae 1 and 2 long, subequal in length; anterior portion of peritrematal shield interrupted. *S. occidentalis* Ewing (p. 334)

Steatonyssus (Steatonyssus) periblepharus Kolenati

Steatonyssus periblepharus Kolenati, 1858, *Wien. ent. Monatschr.* **2**: 6; et 1859, *S.B. Akad. Wiss. Wien* **35**: 186, pl. 8, fig. 34.

Till & Evans, 1964, *Bull. Brit. Mus. (nat. Hist.) Zool.* **11**: 562, figs. 62-67.

Female: Chelicera with segment I, 40 μ ; II, 168 μ ; movable digit 54 μ ; both digits edentate. Four pairs of gnathosomal setae with *c.s.* about 45 μ apart, *hyp.* 2 about 33 μ apart. Deutosternum with eight denticles arranged in a single file. Corniculi membranous; internal malae simple. Tectum capituli tapering, with anterior margin fimbriated. Pedipalp (2-5-6-13) with two-tined apotele; palptrochanter with prominent antero-ventral keel.

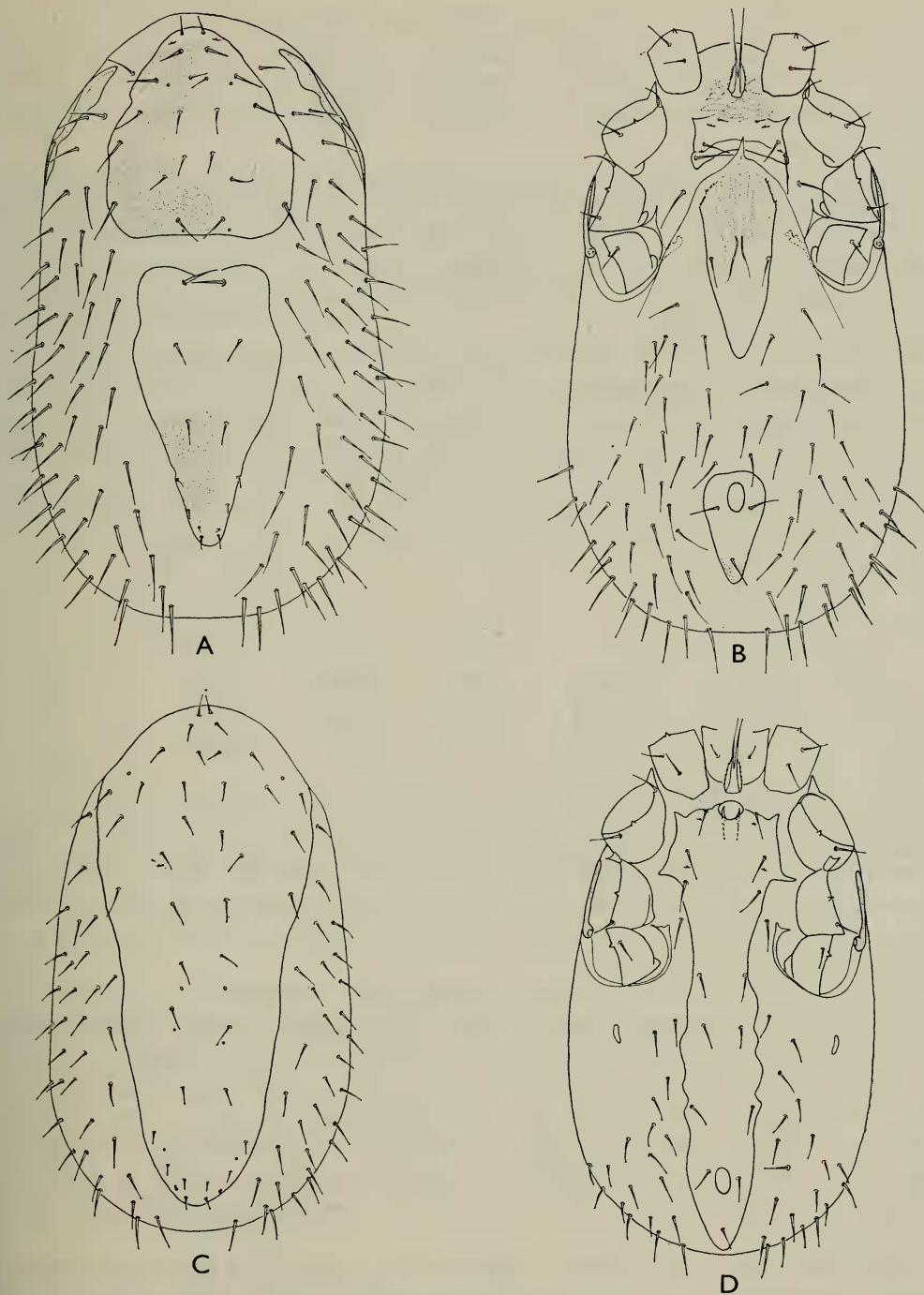


FIG. 87. *Steatonyssus periblepharus* Kolenati. A. Dorsum of idiosoma of female ; B. venter of idiosoma of female ; C. dorsum of idiosoma of male ; D. venter of idiosoma of male.

Podonotal shield ($294\text{--}312\ \mu \times 252\text{--}276\ \mu$) bears 11 pairs of setae distributed as in Text-fig. 87A. Opisthonotal shield ($348\text{--}396\ \mu \times 180\text{--}198\ \mu$) with seven pairs of setae. Seta *J*1 relatively stouter than the other setae on the shield. Surface of both shields reticulated; unsclerotized integument of dorsum with numerous rather stout, spine-like setae.

Tritosternum with hyaline denticulated mambrane; base $38\ \mu$ laciniae $102\ \mu$. Sternal shield ($45\text{--}57\ \mu \times 130\text{--}144\ \mu$) reticulated, not sharply demarkated from presternal area; posterior border of shield heavily sclerotized; bearing three pairs of setae and two pairs of pores; metasternal setae free. Between *st*1, $45\text{--}50\ \mu$; between *st*1 and *st*3, $70\text{--}72\ \mu$. Sternal seta 1 relatively short, not more than half as long as *st*2. Genital shield ($144\text{--}156\ \mu \times 75\text{--}93\ \mu$) tapering, with genital setae only. Anal shield ($114\text{--}135\ \mu \times 80\text{--}94\ \mu$) with par- and postanal setae subequal, about $40\ \mu$ long. Integument of opisthogaster bears numerous setae, those near the margin being relatively longer ($65\ \mu$) and stouter than the others (Text-fig. 87B). Peritreme extends to middle of coxa II; anterior part of peritrematal shield continues to middle of coxa I; posterior part fused with podal shields of coxa IV.

Chaetotaxy of legs normal except genu III ($2\text{--}\frac{2}{1}$, $\frac{2}{1}\text{--}2$), tibia III ($2\text{--}\frac{2}{1}$, $\frac{2}{1}\text{--}2$) and genu IV ($2\text{--}\frac{2}{1}$, $\frac{3}{1}\text{--}1$). Coxa II with prominent anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	102/54	93/69	84/60	108/54
tibia	102/48	84/60	78/54	102/48
tarsus	177/42	156/48	156/48	192/48

Male: Chelicera with segment I, $27\ \mu$; II, $99\ \mu$; movable digit $34\ \mu$; spermadactyl relatively short, grooved, $45\ \mu$ long from base of movable digit; a membranous lobe is present between the spermadactyl and the digit. Fixed digit edentate with distal hyaline boss. Four pairs of gnathosomal setae with *c.s.* about $36\ \mu$ apart, *hyp*.2 about $36\ \mu$ apart. Pedipalp trochanter without ventral keel; other features as in female.

Dorsal shield ($504\ \mu \times 228\ \mu$) with 19 pairs of setae distributed as in Text-fig. 87c. Surface of shield reticulated. Unsclerotized integument of dorsum hypertrichous.

Tritosternum with base $21\ \mu$, laciniae $66\ \mu$. Holoventral shield ($420\ \mu \times 105\ \mu$) narrow, bearing six pairs of setae excluding the anals; metasternal setae on integument beside shield. Between *st*1, $48\ \mu$; between *st*1 and *st*3, $75\ \mu$. Par- and postanal setae subequal, about $24\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 87D. Peritreme extends to anterior margin of coxa III; anterior part of peritrematal shield short, free; posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs as in female. Anterior seta on coxa III short, spinose, with blade-like extension on proximo-anterior margin. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	75/38	66/48	50/45	72/40
tibia	75/34	54/42	50/40	69/33
tarsus	130/32	90/36	90/33	120/30

Protonymph: Chelicera with segment I, 20 μ ; II, 100 μ ; movable digit 30 μ . Four pairs of gnathosomal setae with c.s. about 33 μ apart; *hyp*.2 about 27 μ apart. Pedipalp (1-4-5-12) without keel on trochanter.

Podonotal shield (180 $\mu \times$ 150 μ) with 11 pairs of setae as in Text-fig. 88A; pygidial shield with four pairs of setae; unsclerotized integument of dorsum with 14 pairs of setae.

Tritosternum with base 15 μ , laciniae 60 μ . Sternal shield (140 $\mu \times$ 114 μ) with three pairs of setae and two pairs of pores. Between *st*1, 60 μ ; between *st*1 and *st*3, 96 μ . Anal shield (48 $\mu \times$ 54-57 μ) with par- and postanal setae subequal, about 27 μ long. Integument of venter bears a pair of genital and five pairs of opisthogastric setae (Text-fig. 88B). Peritreme extends nearly to middle of coxa III.

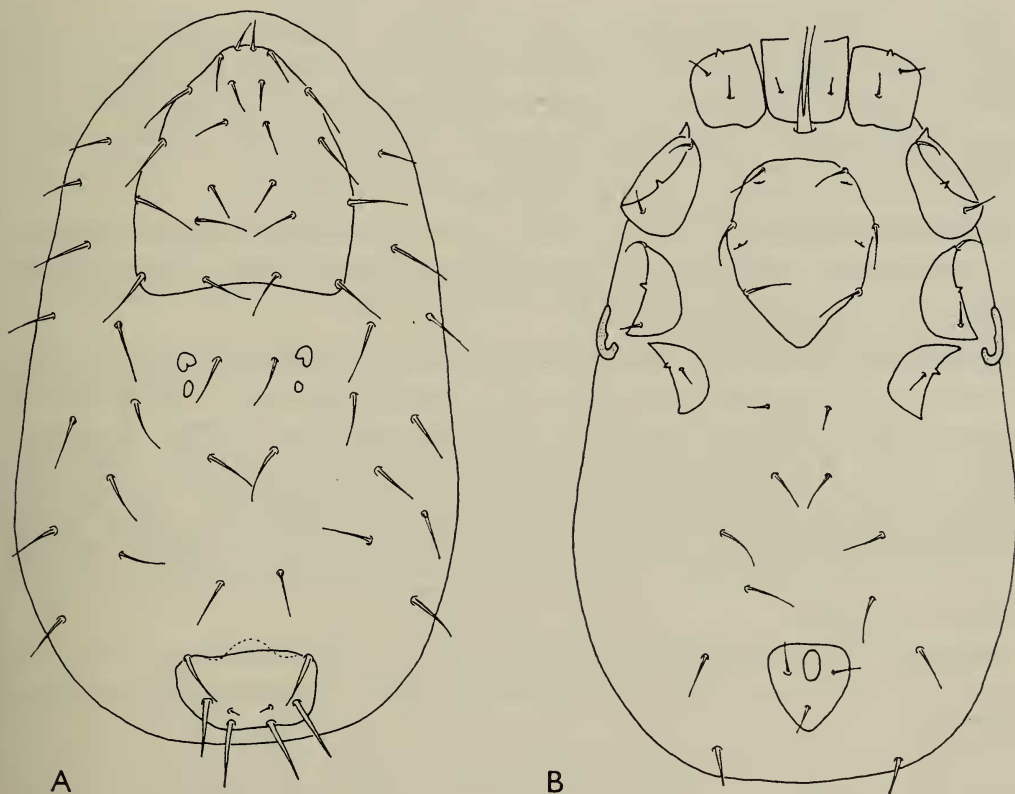


FIG. 88. *Steatonyssus periblepharus* Kolenati, protonymph; dorsum (A) and venter (B) of idiosoma.

Chaetotaxy of legs normal. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	48/40	45/42	36/39	48/36
tibia	45/34	36/39	36/36	48/33
tarsus	90/30	66/30	66/32	102/30

HABITAT : Found in Britain on *Pipistrellus pipistrellus* (Schreber) and *Myotis mystacinus* (Kuhl). Recorded from Europe, North Africa and the Near East, especially on bats of the genera *Pipistrellus* and *Myotis*.

Steatonyssus (Steatonyssus) occidentalis (Ewing)

Ceratonyssus occidentalis Ewing, 1933, *Proc. U.S. nat. Mus.* **82** (art. 30) : 10, figs.

Steatonyssus occidentalis : Radovsky & Furman, 1963, *Ann. ent. Soc. Amer.* **56** : 272, figs.

Till & Evans, 1964, *Bull. Brit. Mus. (nat. Hist.) Zool.* **11** : 559, figs.

Female : Chelicera with segment I, 27 μ ; II, 140 μ ; movable digit 40 μ ; both digits edentate. Four pairs of gnathosomal setae with c.s. about 45 μ apart ; *hyp.2* about 36 μ apart. Deutosternum with six denticles arranged in a single file. Corniculi membranous ; internal malae simple. Tectum capituli tapering, anterior margin weakly serrated. Pedipalp (2-5-6-13) with two-tined apotele ; palp-trochanter with prominent antero-ventral keel.

Podonotal shield (288 $\mu \times$ 282 μ) with 11 pairs of setae distributed as in Text-fig. 89A ; opisthonotal shield (372 $\mu \times$ 204 μ) with seven pairs of setae. Surface of both shields reticulated, opisthonotal shield with striations posteriorly. Unsclerotized integument of dorsum hypertrichous.

Tritosternum with hyaline, denticulated membrane. Sternal shield (40 $\mu \times$ 132 μ) reticulated, with thickened posterior border ; bearing three pairs of setae and two pairs of pores ; metasternal setae free. Between *st1*, 68 μ ; between *st1* and *st3*, 72 μ . Genital shield (144 $\mu \times$ 93 μ) tapering, with genital setae only. Anal shield (120 $\mu \times$ 96 μ) with par- and postanal setae about 40 μ long. Integument of opisthogaster hypertrichous (Text-fig. 89B). Peritreme extends to anterior margin of coxa III ; anterior part of peritrematal shield interrupted, a separate leaf-like portion lying over coxae I-II ; posterior part of peritrematal shield fused with podal elements of coxa IV.

Chaetotaxy of legs normal except genu III ($2-\frac{2}{1}, \frac{2}{\text{st}1}-2$), tibia III ($2-\frac{1}{1}, \frac{2}{1}-2$) and genu IV ($2-\frac{2}{1}, \frac{3}{1}-1$). Coxa II with anterior spine. Length/width (in μ) of leg segments :

	I	II	III	IV
genu	96/57	84/75	72/60	102/54
tibia	96/45	78/60	75/52	102/48
tarsus	162/40	150/45	147/42	198/42

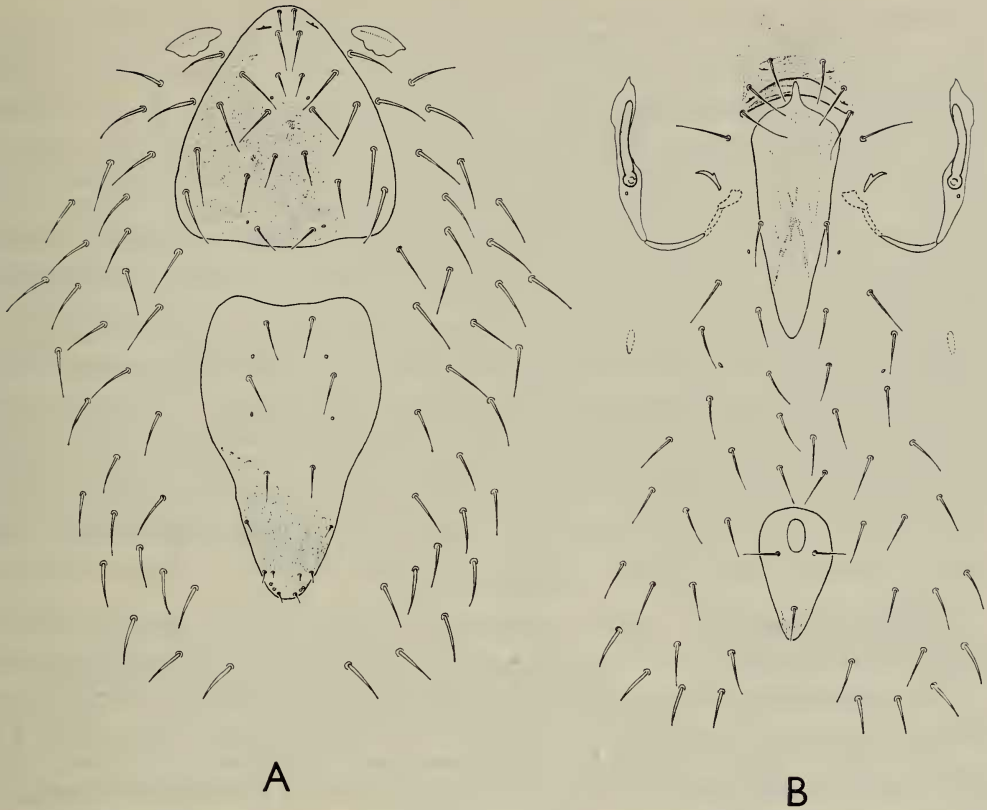


FIG. 89. *Steatonyssus occidentalis* (Ewing), female ; dorsal shields (A) ; ventral shields (B).

Male and Protonymph : Described by Radovsky & Furman (1963) and by Till & Evans (1964).

HABITAT : Found on *Eptesicus serotinus* (Schreber), Wickham Market, Suffolk, 24th June, 1964 (coll. Lord Cranbrook). This is the first record of *S. (S.) occidentalis* from Britain. Previously the species was known only from North America, where it occurs on bats of the genera *Eptesicus*, *Myotis*, *Tadarida*, *Corynorhinus* and *Lasiurus*.

Genus **OPHIONYSSUS** Mégnin

Ophionyssus Mégnin, 1884, *C.R. Soc. Biol. Paris* **35** : 614.
Serpenticola Ewing, 1923, *Proc. U.S. nat. Mus.* **62** (art. 13) : 6.
Sauronyssus Sambon, 1928, *Ann. trop. Med.* **22** : 106.
Neoliponyssus Ewing, 1929, *Manual of External Parasites* : 187.
Oudemansiella Fonseca, 1948, *Proc. zool. Soc. Lond.* **118** : 269.

Type : *Dermanyssus natricis* Gervais, 1844.

Cheliceral digits edentate, movable digit in the female with a well-defined hyaline flap; fixed digit grooved, rounded anteriorly. Movable digit of male chelicera completely fused with the deeply grooved spermadactyl; fixed digit not hooked. Dorsal seta and pilus dentilis absent; arthrodial membrane at base of chelicera without setiform processes. Chaetotaxy of venter of gnathosoma normal, pedipalps with five free segments and a two-tined apotele. Chaetotaxy of pedipalps (2-4/5-5/6-13). Palptrochanter with a shallow, inconspicuous, weakly sclerotized keel. Deutosternum with 6-9 denticles in a single longitudinal row. Corniculi membranous, typically macronyssine. Tectum capituli elongate, obtuse, anterior margin fimbriated.

Dorsal sclerotization of the female of three basic types; one consisting of a podonotal shield bearing nine or ten pairs of setae, two pairs of mesonotal scutellae and a small sub-circular pygidial shield normally lacking setae; the second with a posterior extension of the podonotal shield incorporating opisthonotal setae *J*1 and *J*2, and with a discrete pygidial shield lacking setae; the third consisting of a single dorsal shield incorporating 10 or 11 pairs of setae in the podonotal region and three pairs of *J* setae in the opisthonotal region, with setae *Z*5 on or off the shield. In the male the dorsal shield is entire, bearing 17-24 pairs of setae. Paravertical setae (*z*1) absent.

Tritosternum bipartite, with a denticulate hyaline border. Sternal shield in female with two pairs of setae and two pairs of pores, the third pair of sternal setae and the metasternals being situated on unsclerotized integument. Genital shield narrow, tapering, the genital setae placed on the integument. Anal shield pear-shaped with normal chaetotaxy. Unsclerotized integument of opisthogaster hypertrichous. Peritrematal shields fused posteriorly with podal shields of coxae IV. Metapodal and podal shields weakly developed. Male with a sternito-genital shield bearing two or three pairs of setae; anal shield free.

Chaetotaxy of legs shows several deviations from the normal pattern: femur I ($2-\frac{5}{3}-2$), genu I and tibia I ($2-\frac{3}{2}$, $\frac{2}{1}-2$) or ($2-\frac{2}{1}$, $\frac{2}{1}-2$), femur II ($1-\frac{5}{3}-1$), genu II ($2-\frac{2}{1}$, $\frac{2}{1}-2$), tibia II ($2-\frac{1}{1}$, $\frac{2}{1}-2$), femur III ($1-\frac{3}{1}-0$), genu III ($2-\frac{2}{1}$, $\frac{2}{1}-2$), tibia III ($2-\frac{1}{1}$, $\frac{2}{1}-2$), genu IV ($2-\frac{2}{1}$, $\frac{2}{1}-2$) or ($2-\frac{2}{1}$, $\frac{3}{1}-2$) and tibia IV ($2-\frac{1}{1}$, $\frac{2}{1}-2$). Coxa II without an anterior spine. All ambulacra with a pair of claws.

Protonymph with general gnathosomal characteristics of the female. Podonotal region with 16 pairs of setae (podonotal shield with ten pairs); opisthonotal region with ten pairs (pygidial shield with two pairs, *J*4 and *Z*5) or 11 pairs (pygidial shield with three pairs, *J*4, *S*5 and *Z*5) of setae. Sternal shield with three pairs of setae and two pairs of pores, genital setae present. Opisthogastric cuticle with four pairs of setae. Leg chaetotaxy normal except for genu IV ($1-\frac{2}{0}$, $\frac{2}{0}-1$).

Strandtmann & Wharton (1958) recognize *Sauronyssus* as a distinct genus differing from *Ophionyssus* in the nature of the idiosomal sclerotization of the female. This appears to be the only distinguishing feature between them. The exclusion of setae *Z*5 from the entire dorsal shield of certain *Sauronyssus* suggests that a reduction of the pygidial shield also occurs between the protonymphal and adult female stages of

these species and that the elongate dorsal shield may be formed by the posterior prolongation of the podonotal shield to incorporate setae J_1 , J_3 and J_4 . In the males of both *Ophionyssus* and *Sauronyssus* on the other hand there appears to be no reduction of the pygidial shield which forms (with its protonymphal complement of setae) part of the dorsal shield. The degree of specialization of the idiosomal sclerotization exhibited by the *Ophionyssus-Sauronyssus* complex is no greater than that occurring in certain other genera of highly specialized macronyssines and dermanyssines, for example, compare *Dermanyssus gallinae* and *D. triscutatus* Krantz, and *Ornithonyssus bacoti* and *O. aridus* Furman and Radovsky. In view of this we consider *Sauronyssus* to be synonymous with *Ophionyssus*. The distinction based on the host preferences of *Ophionyssus* (snakes) and *Sauronyssus* (lizards) is not valid. *Ophionyssus monodi* (Hirst) recorded from *Acanthodactylus scutellatus* and *Ophionyssus mabuyae* Till from the skink *Mabuya striata* have the idiosomal sclerotization of the *natricis* type. In fact, the dorsal sclerotization of *O. mabuyae* is intermediate between the conditions in *O. natricis* and *O. saurarum*, having a short posterior extension of the podonotal shield which incorporates two pairs of J setae, but retaining a small pygidial shield.

KEY TO FEMALES

- 1 Dorsal sclerotization consisting of a podonotal shield, two pairs of mesonotal scutellae and a pygidial shield. ***O. natricis*** (Gervais) (p. 337)
- Dorsal sclerotization consisting of a single dorsal shield 2
- 2 Tibia IV with two postero-dorsal setae ($2-\frac{1}{2}, \frac{2}{1}-2$). Dorsal shield with ten pairs of setae in the podonotal region ***O. saurarum*** (Oudemans) (p. 342)
- Tibia IV with three postero-dorsal setae ($2-\frac{1}{2}, \frac{3}{1}-2$). Dorsal shield with 11 pairs of setae in the podonotal region ***O. lacertinus*** (Berlese) (p. 345)

KEY TO MALES

- 1 Dorsal shield with 23–24 pairs of setae. Femur III with ventral seta greatly enlarged, spur-like ***O. lacertinus*** (Berlese) (p. 346)
- Dorsal shield with 16–18 pairs of setae. Femur III with ventral seta normal 2
- 2 Tibia IV with three postero-dorsal setae ($2-\frac{1}{2}, \frac{3}{1}-2$) ***O. natricis*** (Gervais) (p. 340)
- Tibia IV with two postero-dorsal setae ($2-\frac{1}{2}, \frac{2}{1}-2$) ***O. saurarum*** (Oudemans) (p. 342)

Ophionyssus natricis (Gervais)

Dermanyssus natricis Gervais, 1844, *Hist. Nat. Ins. Apt.* **3** : 223.

Ophionyssus natricis : Camin, 1953, *Chicago Acad. Sci.* no. 10 : 1, figs.

Bregetova, 1956, *Opred. Faune. SSSR.* **61** : 160, 223, figs. 556–562.

Ichoronyssus serpentium Hirst, 1915, *Proc. zool. Soc. Lond.* : 383.

?*Serpenticola easti* Ewing, 1925, *Ent. News* **36** : 18.

Female : Chelicera with segment I, 30 μ ; II, 165 μ ; movable digit 45 μ . Both digits edentate, pilus dentilis and dorsal seta absent (Text-fig. 91C). Four pairs of gnathosomal setae with c.s. about 60 μ apart, *hyp.2* about 42 μ apart. Deutosternum with eight or nine denticles arranged in a single file. Corniculi membranous, internal malae slender, elongated (Text-fig. 91A). Tectum capituli with anterior margin

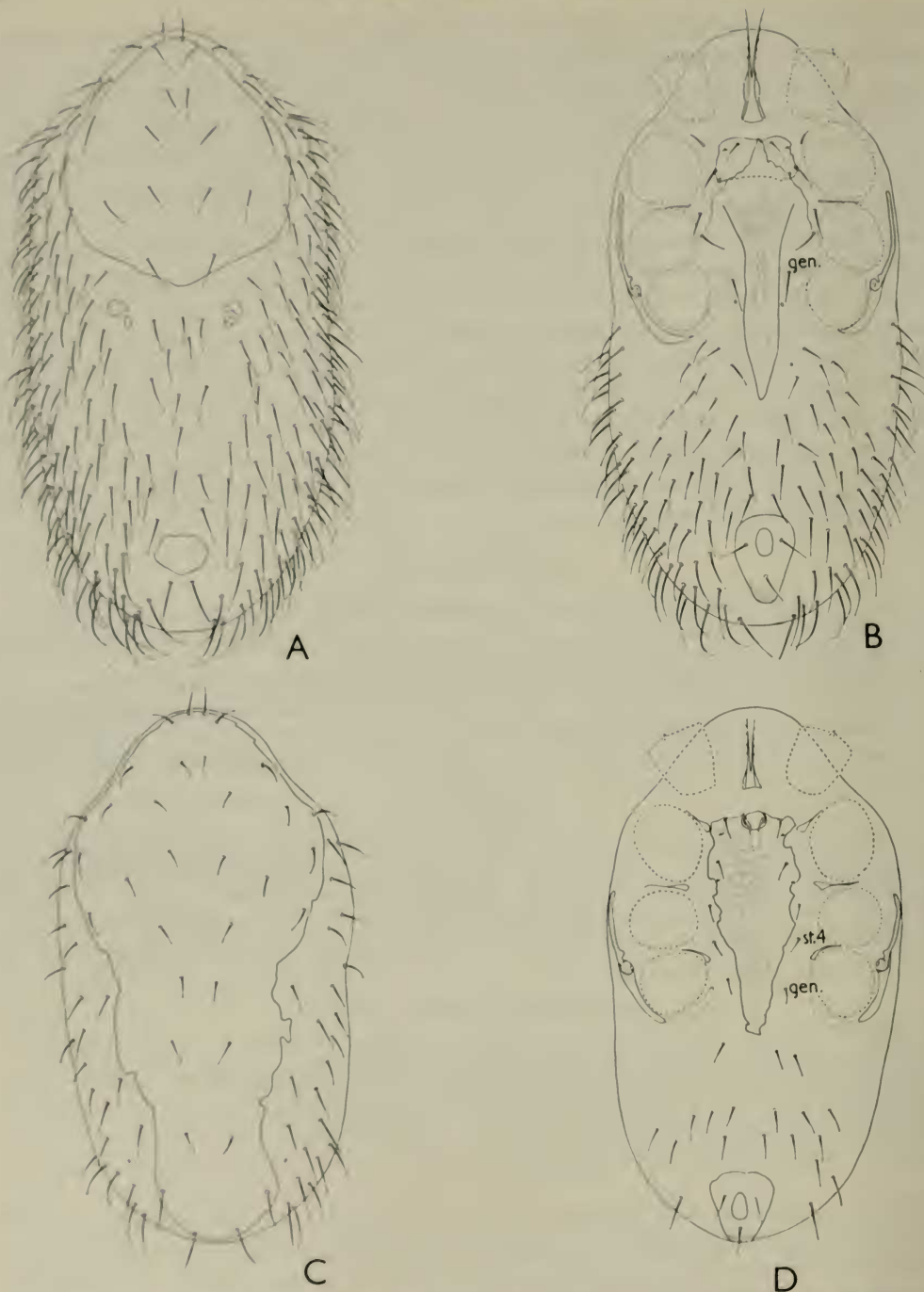


FIG. 90. *Ophionyssus natricis* (Gervais). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. dorsum of idiosoma of male; D. venter of idiosoma of male.

fimbriated. Pedipalp (2-5-6-13) with two-tined apotele; palptrochanter with a shallow, inconspicuous, weakly sclerotized keel.

Podonotal shield ($300\ \mu \times 276\ \mu$) with ten pairs of setae distributed as in Text-fig. 90A; two pairs of mesonotal scutellae lie posterior to the podonotal shield. Surface of podonotal shield granular, weakly reticulated antero-laterally. Pygidial shield ($54\ \mu \times 45\ \mu$) without setae. Unsclerotized integument of dorsum shows marked hypertrichy.

Tritosternum with hyaline membrane; base $54\ \mu$, laciniae $96\ \mu$. Sternal shield ($45\ \mu \times 114\ \mu$) granular, with two pairs of setae and two pairs of pores; the third pair of setae and the metasternals are situated on the striated integument. Between *st*1, $42\ \mu$; between *st*1 and *st*3, $102\ \mu$. Genital shield (about $135\ \mu \times 45\ \mu$) slender and tapering with the genital setae on the integument beside the shield. Anal shield ($78\ \mu \times 72\ \mu$) with paranal setae $33\ \mu$ postanal seta $36\ \mu$ long. Sclerotization and chaetotaxy of venter as in Text-fig. 90B. Peritreme extends to posterior margin of coxa II; peritrematal shield fused posteriorly with podal elements of coxa IV.

Chaetotaxy of legs shows deviations from the normal pattern on most segments: femur I ($2-\frac{5}{3}-2$), femur II ($1-\frac{5}{3}-1$) femur III ($1-\frac{3}{1}-0$); genu I ($2-\frac{3}{2}, \frac{2}{1}-2$), genu III ($2-\frac{2}{1}, \frac{2}{1}-2$), genu IV ($2-\frac{2}{1}, \frac{3}{1}-2$); tibia I ($2-\frac{3}{2}, \frac{2}{1}-2$), tibia III ($2-\frac{1}{1}, \frac{2}{1}-2$). Coxa II without anterior spine. Length/width (in μ) of leg segments:

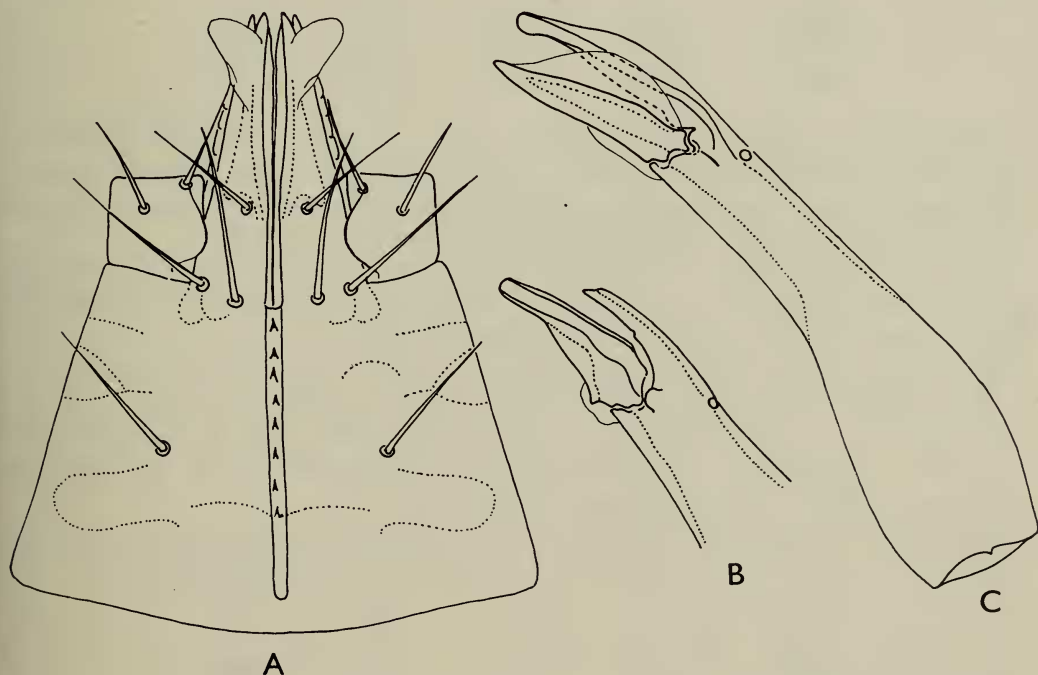


FIG. 91. *Ophionyssus natricis* (Gervais). A. Venter of gnathosoma of female; B. chelicera of male; C. chelicera of female.

	I	II	III	IV
genu	75/45	60/48	60/45	72/40
tibia	75/40	60/45	54/40	66/36
tarsus	123/36	96/40	90/36	110/33

Male: Chelicera with segment I, 18 μ ; II, 96 μ . Fixed digit edentate; movable digit completely fused with grooved spermadactyl (Text-fig. 91B). Four pairs of gnathosomal setae with c.s. about 42 μ apart, *hyp.2* about 36 μ apart. Other features generally as in female.

Dorsal shield (492 $\mu \times$ 240 μ) with 17 pairs of setae distributed as in Text-fig. 90c. Surface of shield mainly granular with reticulations antero-laterally.

Tritosternum with hyaline membrane; base 20 μ , laciniae 70 μ . Sternito-genital shield (204 $\mu \times$ 81 μ) with *st1* and *st2* on the shield, *st3*, *st4* and the genital setae on the cuticle lateral to the shield. Between *st1*, 51 μ ; between *st1* and *st3*, 84 μ . Anal shield (66 $\mu \times$ 60 μ) with par- and postanal setae about 27 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 90d. Peritreme extends to anterior margin of coxa III; peritrematal shield fused posteriorly with podal shield of coxa IV.

Chaetotaxy of legs as in female. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	60/36	51/39	48/36	60/33
tibia	60/33	51/38	48/33	60/33
tarsus	102/33	75/30	75/30	93/30

Protonymph: Chelicera with segment I, 15 μ ; II, 110 μ ; movable digit 28 μ . Four pairs of gnathosomal setae with c.s. about 39 μ apart, *hyp.2* about 27 μ apart. Deutosternum with nine denticles arranged in a single file. Pedipalp (1-4-5-12) with two-tined apotele. Other gnathosomal features as in female.

Podonotal shield (204 $\mu \times$ 192 μ) with eleven pairs of setae distributed as in Text-fig. 92A; setae *s6* and *r2*, *r3*, *r5* and *r6* are situated on the unsclerotized integument. Pygidial shield (63 $\mu \times$ 75 μ) bears three pairs of setae.

Tritosternum with hyaline border; base 20 μ , laciniae 75 μ . Sternal shield (110 $\mu \times$ 78 μ) with three pairs of setae and two pairs of pores. Between *st1*, 48 μ ; between *st1* and *st3*, 80 μ . Anal shield (48 $\mu \times$ 48 μ) with paranal setae 21 μ , postanal seta 24 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 92B. Peritremes extend to anterior margin of coxa III.

Chaetotaxy of legs differs from the normal pattern in the presence of a postero-lateral seta on genu IV (1— $\frac{2}{0}$, $\frac{2}{0}$ —1). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	42/36	42/36	40/33	48/30
tibia	48/33	42/36	36/30	48/30
tarsus	84/30	60/30	60/27	66/27

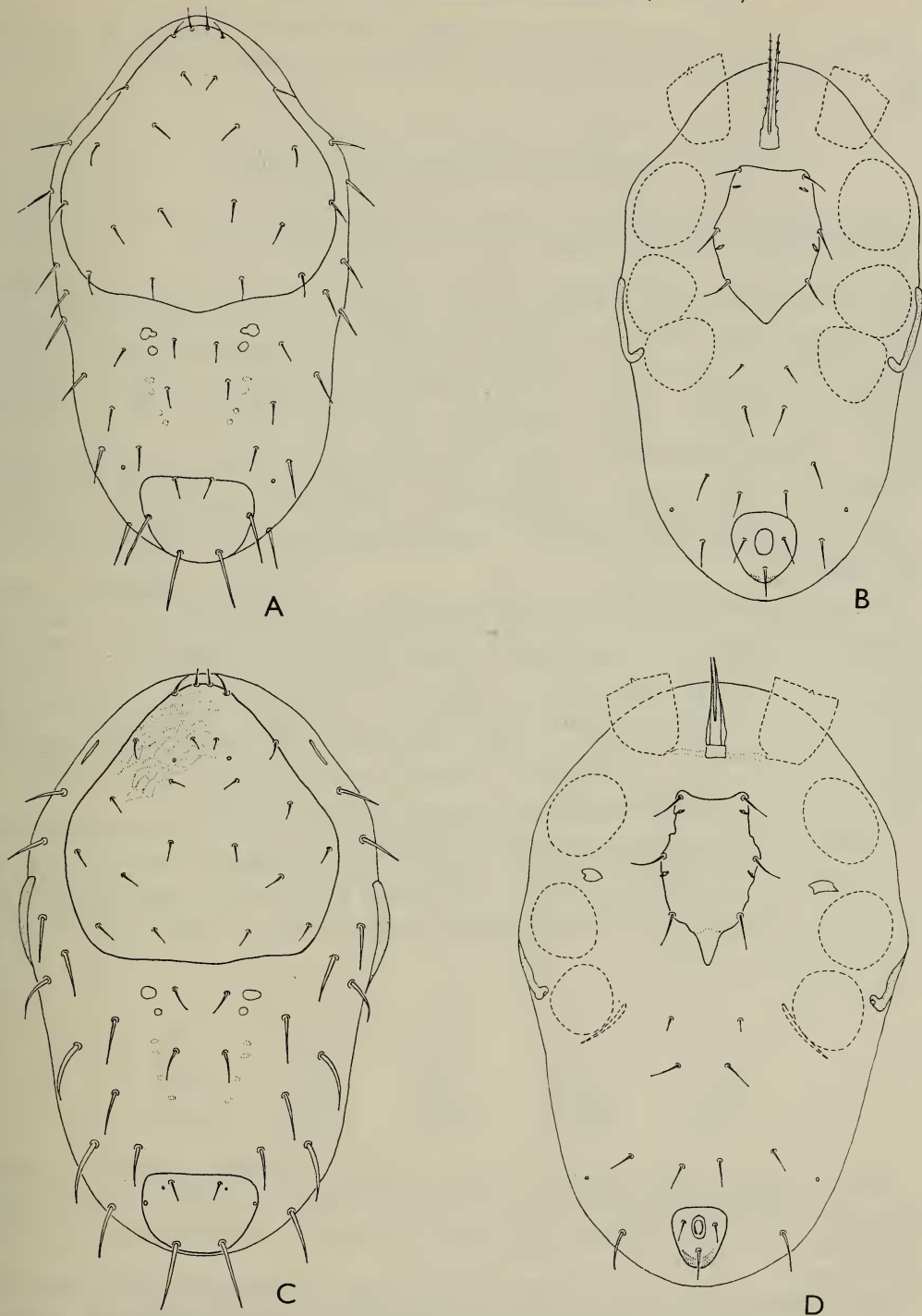


FIG. 92. A-B. *Ophionyssus natricis* (Gervais), proto-nymph; dorsum (A) and venter (B) of idiosoma. C-D. *Ophionyssus saurorum* (Oudemans), proto-nymph; dorsum (C) and venter (D) of idiosoma.

HABITAT: A common ectoparasite of snakes and lizards in vivaria all over the world. It has also been found in natural conditions on a wide variety of snakes in Africa.

Ophionyssus saurorum (Oudemans)

Liponyssus saurorum Oudemans, 1901, *Tijdschr. Ned. dierk. Vereen.* (2) 7: 66.

Sauronyssus saurorum: Bregetova, 1956, *Opred. Faune SSSR.* 61: 218, figs.

Female: Chelicera with segment I, $36\ \mu$; II, $147\ \mu$; movable digit $40\ \mu$. Both digits edentate, pilus dentilis and dorsal seta absent. Four pairs of gnathosomal setae with c.s. about $60\ \mu$ apart, *hyp.2* about $42\ \mu$ apart. Deutosternum with six denticles arranged in a single file. Corniculi membranous; internal malae elongate. Tectum capituli with anterior margin fimbriated. Pedipalp (2-5-6-13) with two-tined apotele; palptrochanter with a low ventral keel.

Dorsal shield ($670\ \mu \times 192\ \mu$) entire, slender, bearing 13 pairs of setae distributed as in Text-fig. 93A. Surface of shield with a reticulated pattern which tends to become punctate posterior to setae *j4*. Unsclerotized integument of dorsum markedly hypertrichous.

Tritosternum with denticulate, hyaline border; base $45\ \mu$, laciniae $78\ \mu$ long. Sternal shield ($42\ \mu \times 120\ \mu$) with two pairs of setae and two pairs of pores; the third pair of setae and the metasternals are situated on unsclerotized integument. Between *st1*, $57\ \mu$; between *st1* and *st3*, $96\ \mu$. Genital shield (about $150\ \mu \times 60\ \mu$) tapering; genital setae on the unsclerotized integument. Anal shield ($105\ \mu \times 75\ \mu$) with par- and postanal setae about $33\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 93B. Peritreme extends to about anterior third of coxa II; peritrematal shield fused posteriorly with podal elements of coxa IV.

Chaetotaxy of legs shows deviations from the normal pattern on most segments, as in *O. natricis*. In addition, tibia IV bears only three dorsal setae ($2-\frac{1}{1}, \frac{2}{1}-2$). Relatively stout setae are present on trochanter I (*d*), femur I (*ad*₁ and *pd*₁) and femur II (*ad*₁ and *pd*₁₋₂). Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	102/45	80/48	78/40	93/40
tibia	100/42	75/48	75/40	90/36
tarsus	180/36	110/40	120/36	120/36

Male: Chelicera with segment I, $20\ \mu$; II, $93\ \mu$; fixed digit edentate; movable digit completely fused with short, grooved spermadactyl. Four pairs of gnathosomal setae with c.s. about $42\ \mu$ apart, *hyp.2* about $39\ \mu$ apart. Other gnathosomal features as in female.

Dorsal shield ($528\ \mu \times 264\ \mu$) with 16 pairs of setae distributed as in Text-fig. 93C; one or more additional unpaired setae may be situated on the margins of the podo- or

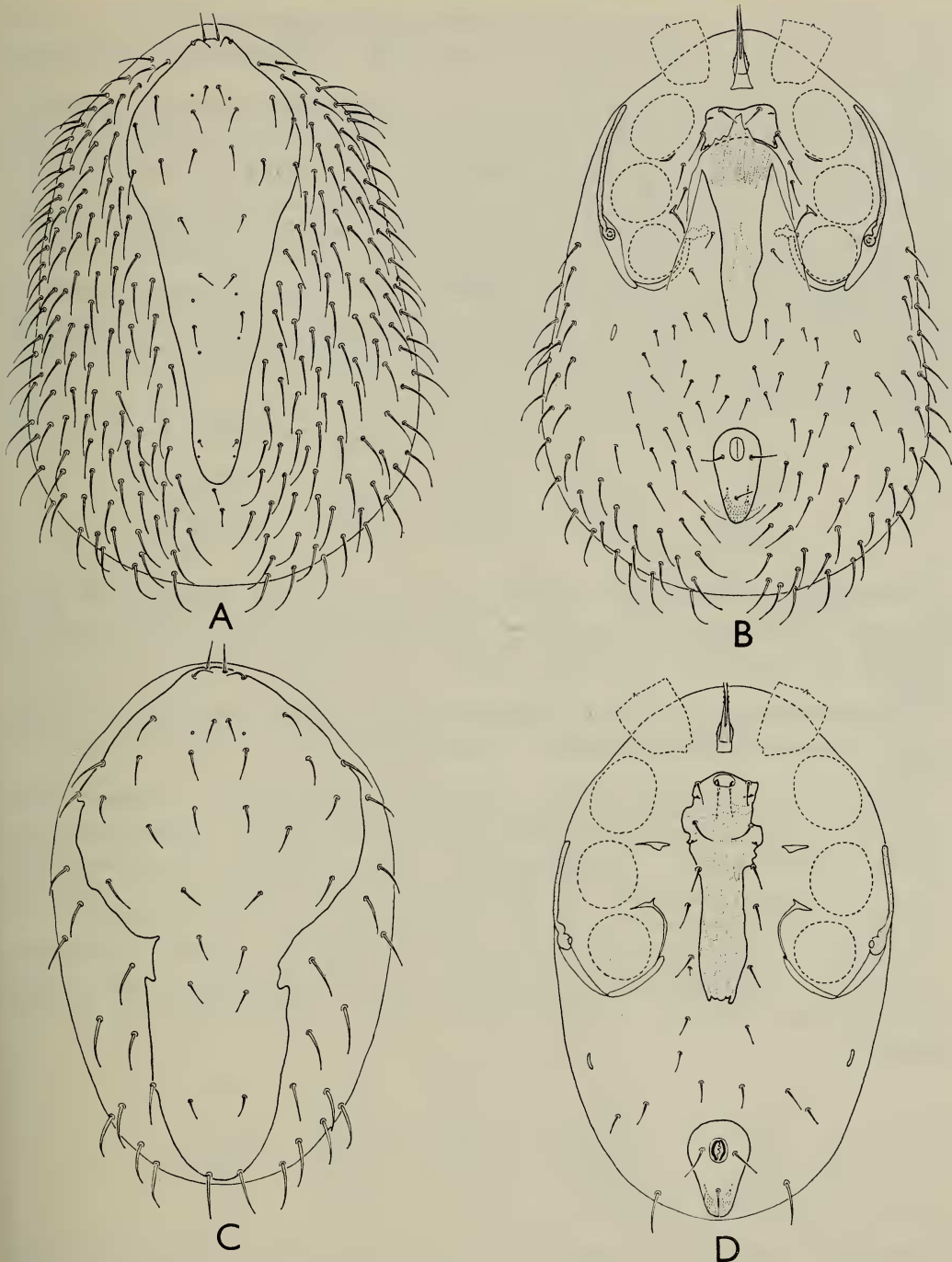


FIG. 93. *Ophionyssus saurorum* (Oudemans). A. Dorsum of idiosoma of female; B. venter of idiosoma of female; C. dorsum of idiosoma of male; D. venter of idiosoma of male.

opisthonotal regions. Surface of shield with a reticulated pattern which has a slight tendency to become punctate near the posterior tip. Unsclerotized integument of dorsum with 10 or 12 pairs of setae.

Tritosternum with base $24\ \mu$, laciniae $48\ \mu$. Sternito-genital shield ($228\ \mu \times 80\ \mu$) reticulated, with three pairs of setae and two pairs of pores; metasternal and genital setae situated on the unsclerotized integument. Anal shield ($72\ \mu \times 63\ \mu$) with paranal setae $36\ \mu$ long, postanal seta $30\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 93D. Peritreme extends to posterior margin of coxa II; peritrematal shield fused posteriorly with podal elements of coxa IV.

Chaetotaxy of legs as in female. Relatively stout spine-like setae present on coxae II and III, trochanter I (*d*), femora I and II (*ad*₁ and *pd*₁₋₂). Seta *v* on femora III and IV is stout basally, tapering distally. Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	70/40	60/45	60/40	75/40
tibia	70/36	57/42	60/40	75/40
tarsus	120/36	93/36	84/34	110/34

Protonymph: Chelicera with segment I, $20\ \mu$; II, $90\ \mu$; movable digit $24\ \mu$. Four pairs of gnathosomal setae with *c.s.* about $38\ \mu$ apart, *hyp.2* about $27\ \mu$ apart. Pedipalp (1-4-5-12) with two-tined apotele. Other gnathosomal features as in female.

Podonotal shield ($213\ \mu \times 180\ \mu$) with eleven pairs of setae distributed as in Text-fig. 92C. Surface of shield reticulated. Pygidial shield ($84\ \mu \times 81\ \mu$) bears two pairs of setae.

Tritosternum with hyaline border; base $32\ \mu$, laciniae $60\ \mu$. Sternal shield ($126\ \mu \times 74\ \mu$) with three pairs of setae and two pairs of pores; between *stI*, $48\ \mu$ between *stI* and *st3*, $87\ \mu$. Anal shield ($36\ \mu \times 40\ \mu$) with par- and postanal setae about $20\ \mu$ long. Chaetotaxy of opisthogaster as in Text-fig. 92D. Peritreme extends to anterior margin of coxa III; peritrematal shields not developed.

Chaetotaxy of legs normal, except genu IV which has a postero-lateral seta (*1— $\frac{2}{0}$, $\frac{2}{0}$ —1*). Relatively stout setae present on the dorsal surfaces of femora I (*ad*₁ and *pd*₁), II (*ad*₁ and *pd*₁₋₂), III (*ad*₁) and IV (*ad*₁₋₂). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	48/33	42/36	45/33	57/30
tibia	54/33	45/36	45/33	57/32
tarsus	102/30	70/30	72/28	75/27

HABITAT: Recorded from lizards [*Lacerta agilis* Linn. and *L. viridis* (Laurenti)] in the Netherlands, Hungary and Italy. In Britain specimens have been obtained from *L. agilis* in Dorset, and from lizards at Albury, Surrey, and near Aberdeen, Scotland.

Ophionyssus lacertinus (Berlese)

Leiognathus lacertinus Berlese, 1892, *Acari, Myr. Scorp. Ital.* fasc. 70, no. 3, figs.

Female: Chelicera with segment I, $30\ \mu$; II, $180\ \mu$; movable digit $50\ \mu$. Four pairs of gnathosomal setae with *c.s.* about $66\ \mu$ apart, *hyp.2* about $38\ \mu$ apart. Deutosternum with about seven denticles arranged in a single file. Corniculi membranous; internal malae elongated. Pedipalp (2-5-6-13) with two-tined apotele; palptrochanter with a very shallow, inconspicuous keel.

Dorsal shield ($696\ \mu \times 264\ \mu$) with at least 14 pairs of setae distributed as in Text-fig. 94A. There may be one or two terminal setae, or none, at the posterior tip of the shield. Surface of shield with a reticulate pattern which tends to become punctate.

Tritosternum with a hyaline border; base $72\ \mu$, laciniae $80\ \mu$. Sternal shield ($40\ \mu \times 120\ \mu$) with two pairs of setae and two pairs of pores. Between *st1*, $54\ \mu$; between *st1* and *st3*, $100\ \mu$. Genital shield ($144\ \mu \times 54\ \mu$) tapering. Anal shield ($106\ \mu \times 84\ \mu$) with paranal setae about $38\ \mu$, postanal seta about $30\ \mu$ long. Peri-

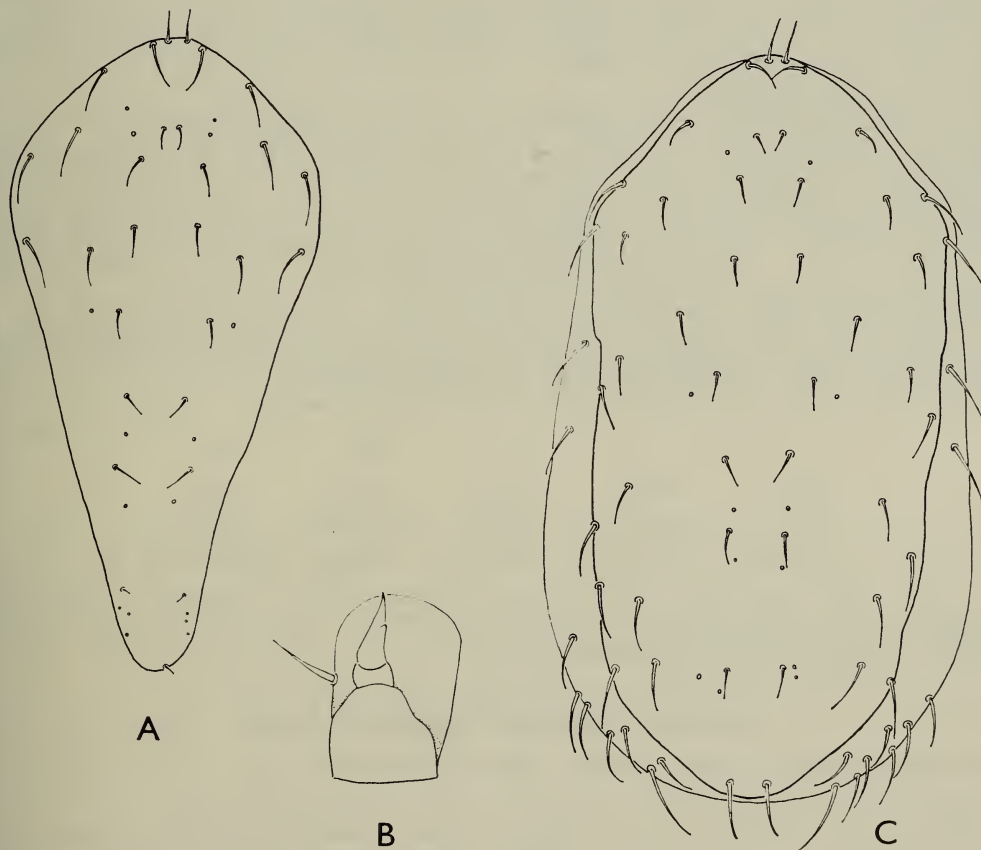


FIG. 94. *Ophionyssus lacertinus* (Berlese). A. Dorsal shield of female; B. femur III of male, ventral view; C. dorsum of idiosoma of male.

treme extends to anterior margin of coxa II; peritrematal shield fused posteriorly with podal elements of coxa IV.

Chaetotaxy of legs as described for *O. natricis*. Relatively stout setae present on trochanters I, III and IV (*d*), femora I–II (*ad*₁ and *pd*_{1–2}), femora III–IV (*ad*_{1–2}). Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	102/45	84/51	84/48	105/42
tibia	102/40	78/48	78/42	105/39
tarsus	186/38	123/42	135/36	170/36

Male: Chelicera with segment I, 18 μ ; II, 96 μ ; fused movable digit and sperma-dactyl about 40 μ long. Four pairs of gnathosomal setae with *c.s.* about 40 μ apart, *hyp.2* about 30 μ apart. Deutosternum with eight denticles arranged in a single file. Other gnathosomal features as in female.

Dorsal shield (516 $\mu \times$ 250 μ) broader than in female, with 13 pairs of setae distributed as in Text-fig. 94C; one or more additional unpaired setae may be present on the margin of the opisthonotal region. Unsclerotized integument of dorsum with nine or ten pairs of setae.

Tritosternum with base 20 μ , laciniae 54 μ . Sternito-genital shield (216 $\mu \times$ 75 μ) reticulated, with *st1* and *st2* on the shield, *st3*, *st4* and genital setae on the unsclerotized integument. Between *st1*, 45 μ ; between *st1* and *st3*, 90 μ . Anal shield (60 $\mu \times$ 57 μ) with paranal setae 36 μ , postanal seta 30 μ long. Opisthogaster with about seven pairs of setae. Peritreme extends to posterior margin of coxa II; peritrematal shield fused posteriorly with podal elements of coxa IV.

Chaetotaxy of legs and setal form as in female. In addition, coxa III bears a relatively stout anterior seta and femur III has a greatly enlarged, spur-like ventral seta (Text-fig. 94B). Length/width (in μ) of leg segments:

	I	II	III	IV
genu	66/38	60/40	60/42	70/36
tibia	70/36	57/40	60/40	72/34
tarsus	117/32	80/33	96/33	105/30

HABITAT: Parasitic on *Lacerta muralis* (Laurenti) in Italy and on *Lacerta viridis* (Laurenti) imported into Britain from Italy.

Subfamily **DERMANYSSINAE** Kolenati

Dermanyssidae Kolenati, 1859, *S.B. Akad. Wiss. Wien* 35: 171.

Adults: Chelicerae of female strongly modified, resembling stylets; second segment enormously elongated, slender; digits minute, weakly dentate. Pilus dentilis, dorsal seta and arthrodial processes absent. Male chelicera with second segment

normal in length, spermadactyl long and entirely fused with the movable digit ; fixed digit slender, usually shorter than the spermadactyl, rarely equal in length. Chaetotaxy of venter of gnathosoma normal. Pedipalps with five free segments, apotele two-tined ; chaetotaxy of trochanter to tibia (2-5-6-14) in *Liponyssoides* and some *Dermanyssus*, but showing deficiency on femur and tibia, rarely genu, in most *Dermanyssus*. Palptrochanter without medio-ventral keel. Deutosternum with nine or more denticles in a single file. Hypostome compact, elongate ; corniculi never horn-like, usually membranous ; internal malae small, simple. Tectum capituli in the form of a triangular lobe.

Dorsum of idiosoma of female with reduced sclerotization comprising an entire shield formed by the posterior extension of the podonotal shield ; mesonotal scutellae sometimes present ; small pygidial shield retained in some *Liponyssoides*. Male with entire dorsal shield. Primary chaetotaxy of the dorsum of the idiosoma showing hypotrichy, paraverticlar seta (z_1) absent, dorsal series (J) often reduced. Hypertrichy of lateral and marginal series and of the opisthogaster apparent in some species, particularly *Liponyssoides*. Dorsal setae simple.

Tritosternum well developed, biramous, laciniae smooth or pilose ; denticulate hyaline margin present or absent. Sternal shield in the female with two, rarely three, pairs of setae and two pairs of pores ; metasternal setae present or absent. Genital shield broadly rounded or tapering posteriorly and bearing one pair of genital setae. Anal shield normal, aciculated area conspicuous ; no euanal setae. Metapodal shields small, inconspicuous. Peritrematal shield fused with the podal shields posterior to coxae IV ; peritremes variable in length. Podal shields weakly developed. Male with holoventral shield, or sternito-genital and ventro-anal shields, or sternito-genital and anal shields. Genital orifice presternal.

All legs six-segmented with well developed ambulacra. Segmental chaetotaxy extremely diverse and often showing intraspecific variation. Tarsi III and IV in male with seta pv_2 modified into a short, tooth-like projection. Coxae II-IV without sclerotized ridges. Anterior spine of coxa II usually absent, present in some *Liponyssoides*.

Larva : Relatively inactive, non-feeding instar. Chelicerae without elongated second segment ; digits minute, edentate, lacking setae, fissures and arthrodial processes. Pedipalps in *Dermanyssus* apparently four-segmented (tibia and tarsus fused), chaetotaxy of basal three segments (0-4-5). Hypostome with two pairs of setae ; corniculi and internal malae degenerate ; deutosternal denticles weak or absent. Idiosoma without distinct sclerotization. Podonotal region with seven to nine pairs of short setae, opisthonotal region with variable number of microsetae, J_5 always present. Tritosternum biramous, relatively small. Sternal region with three pairs of setae, opisthogastric region with two pairs of setae excluding the normal three setae associated with the non-functional anus. Stigmata and peritremes absent. Leg chaetotaxy normal for this instar.

Larval stage known only for a few species.

Protonymph: Active, feeding instar. Chelicerae, basis-capituli and hypostome as in the female. Pedipalpal chaetotaxy (1-4-5-12), rarely genu and tibia deficient; palptrochanter without medio-ventral keel.

Dorsal sclerotization comprising well developed podonotal shield with marked posterior extension; mesonotal scutellae conspicuous, pygidial shield minute, bearing at the most one pair of setae, or represented by small scutellae or absent. Podonotal shield with 7-11 pairs of setae. Opisthonotum with four or five pairs of setae in the *J* series, never markedly hypertrichous. Tritosternum as in female. Intercoxal region with three pairs of sternal setae on a distinct sternal shield; genital setae present (*Liponyssoides*) or suppressed (*Dermanyssus*). Opisthogastric cuticle with six pairs of setae. Anal shield well-defined and with normal three setae. Stigmata and short peritremes present. Chaetotaxy of legs normal for this instar.

Deutonymph: Active feeding instar. Gnathosoma, dorsal sclerotization and chaetotaxy as in the female. Tritosternum biramous, laciniae long, smooth or pilose. Sternito-genital shield well sclerotized and normally bearing four pairs of sternal setae, rarely three pairs due to the suppression of the metasternals; genital setae present, on or flanking the posterior extremity of the sternito-genital shield. Chaetotaxy of opisthogaster as in female; anal shield well developed and with three setae. Metapodal shields small, stigmata and peritremes as in female. Leg chaetotaxy as in corresponding adults.

Genus *DERMANYSSUS* De Geer

Dermanyssus De Geer, 1778, *Mém. Hist. Ins.* 7: 106.

Type: *Acarus gallinae* De Geer, 1778.

Chelicerae of female resembling stylets, second segment greatly elongated, digits minute, weakly dentate. Pilus dentilis, dorsal seta and arthrodial processes absent. Male chelicera with segments normal in size, fixed digit reduced, spermadactyl long, grooved, completely fused with movable digit. Chaetotaxy of venter of gnathosoma normal; pedipalp with five free segments and a two-tined apotele. Chaetotaxy of palptrochanter to tibia normal (2-5-6-14) in some *Dermanyssus*, but usually showing deficiency on the femur and tibia (2-4-6-12) and occasionally also on the genu (2-4-5-7/8). Deutosternum with nine or more denticles in single file. Hypostome elongate, corniculi membranous; internal malae small, simple; tectum capituli elongate, triangular, with smooth margin.

Dorsal shield in female entire but reduced, mesonotal scutellae sometimes present; podonotal region of shield with 7 to 11 pairs of setae (setae *j3* and *z1* absent); opisthonotal region with from one to four pairs of setae. Male with entire dorsal shield incorporating a greater number of setae than in the female, usually 18-20 pairs (13-14 pairs in the podonotal and 5-6 pairs in the opisthonotal region).

Tritosternum normal, bipartite, with denticulate, hyaline margin. Sternal shield usually with two pairs of setae and one or two pairs of pores; metasternal setae

present or absent. Genital shield with genital setae only; anal shield with normal chaetotaxy; metapodal shields inconspicuous. Chaetotaxy of opisthogastric cuticle variable. Peritremes variable in length; peritrematal shields fused with podal shields posterior to coxae IV. Male with holoventral shield, or with sternitogenital and ventro-anal shields.

In most species the segmental chaetotaxy of the legs shows deviations from the normal complement and protonymphal patterns are often retained, especially on tibiae II–IV. Intraspecific variation is not uncommon. The *ad* and *pd* series on tibia I each comprises only two setae, and the *ad* series on tibia IV and *pd* series on genu IV also only two setae. Tarsi III and IV in male with seta *pv*₂ modified to form a tooth-like projection. Ambulacra and claws well developed, coxa II without anterior spine.

Immature stages have the features described in the diagnosis of the subfamily.

KEY TO FEMALES

- 1 Dorsal shield with at least eight pairs of setae in the podonotal region (*j*₄ present); no conspicuous pore on shield posterior to seta *s*₄. Palptibia with 12 setae. Metasternal setae usually present 2
- Dorsal shield with seven pairs of setae in the podonotal region (*j*₄ absent); a conspicuous pore present on each side of the shield posterior to seta *s*₄. Palptibia with 7 or 8 setae. Metasternal setae absent ***D. alaudae*** (Schrank) (p. 359)
- 2 Dorsal shield with four pairs of setae in *J* series (*J*₂ present); with 9 or 11 pairs of setae in podonotal region (setae *z*₆ present) 3
- Dorsal shield with three pairs of setae in *J* series (*J*₂ absent); with eight pairs of setae in podonotal region (*z*₆ absent or on unsclerotized cuticle) 4
- 3 Peritreme extends at least to middle of coxa II. Setae *j*₁ and *s*₁ situated on the dorsal shield. Genu IV with one postero-lateral setae ***D. gallinae*** (De Geer) (p. 350)
- Peritreme extends to middle of coxa III. Setae *j*₁ and *s*₁ off the dorsal shield. Genu IV with two postero-lateral setae ***D. chelidonis*** Oudemans (p. 353)
- 4 Opisthogaster with arc of stout, spine-like setae. Anal shield with maximum width about one and one-half times its length to base of postanal seta. Setae *z*₂ and *z*₄ on dorsal shield considerably longer than seta *j*₄. Tibia I with two ventral setae ***D. quintus*** Vitzthum (p. 361)
- Opisthogaster without arc of stout spines. Anal shield with maximum width approximately equal to its length. Setae *z*₂, *z*₄ and *j*₄ on dorsal shield subequal. Tibia I with three ventral setae ***D. hirundinis*** (Hermann) (p. 356)

KEY TO PROTONYMPHS¹⁰

- 1 Podonotal shield with nine pairs of setae, *j*₁ on the shield; opisthonotal region of dorsum with *J* series complete (*J*₁–*J*₅) 2
- Podonotal shield with seven or eight pairs of setae, *j*₁ off the shield; opisthonotal region of dorsum with setae *J*₂ lacking 3
- 2 Posterior extension of podonotal shield relatively short, rounded, reaching level of setae *J*₁ (Text-fig. 97A) ***D. gallinae*** (De Geer) (p. 353)
- Posterior extension of podonotal shield relatively long, pointed, extending beyond level of setae *J*₂ (Text-fig. 97B) ***D. chelidonis*** Oudemans (p. 356)

¹⁰ Protonymph of *D. quintus* Vitzthum not known.

- 3 Podonotal shield with eight pairs of setae (j_4 present) ; palptibia with 12 setae
D. hirundinis (Hermann) (p. 358)
- Podonotal shield with seven pairs of setae (j_4 absent) ; palptibia with eight setae
D. alaudae (Schränk) (p. 360)

Dermanyssus gallinae (De Geer)

Acarus gallinae De Geer, 1778, *Mém. Hist. Ins.* 7 : 111.

Dermanyssus gallinae: Evans & Till, 1962, *Ann. Mag. nat. Hist.* (13) 5 : 283.

Dermanyssus acium Dugès, 1834, *Ann. Sci. nat. zool.* (2) 1 : 18.

Dermanyssus epotomydis Ewing, 1933, *Proc. U.S. nat. Mus.* 82 (art. 30) : 11.

[For detailed synonymy see Oudemans (1936), p. 299.]

Female : Chelicera with segment I, $45\ \mu$; II, approximately $276\ \mu$; digits minute, weakly dentate (Text-fig. 96c). Four pairs of gnathosomal setae with *c.s.* about $57\ \mu$ apart ; *hyp.2* about $45\ \mu$ apart ; *hyp.1* relatively stout. Deutosternum with 11 denticles arranged in single file. Corniculi membranous, with sclerotized bars (Text-fig. 96B). Tectum capituli elongate, triangular, with smooth margin. Pedipalp (2-4-6-12) with two-tined apotele.

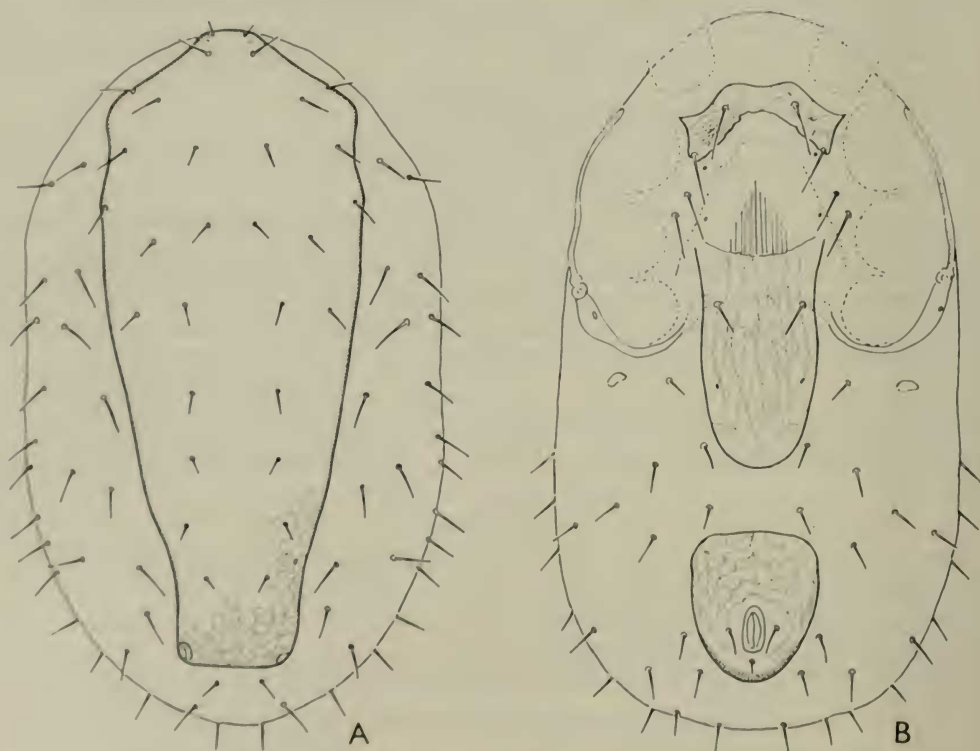


FIG. 95. *Dermanyssus gallinae* (De Geer), female ; dorsum (A) and venter (B) of idiosoma.

Dorsal shield ($756 \mu \times 300 \mu$) with 15 pairs of setae distributed as in Text-fig. 95A; setae J_5 situated posterior to the shield; setae J_3 and J_4 sometimes asymmetrically arranged; J_3 may be unpaired. Surface of shield reticulated.

Tritosternum biramous, with denticulate, hyaline margin. Sternal shield ($24 \mu \times 150 \mu$) reticulated, with two pairs of setae and one pair of pores; setae st_3 , metasternal setae and two pairs of pores situated on the unsclerotized cuticle. Between st_1 , 78μ ; between st_1 and st_3 , 88μ . Genital shield ($198 \mu \times 126 \mu$) reticulated; with genital setae only. Anal shield ($140 \mu \times 123 \mu$; maximum width 150μ) with paranal setae 36μ long, postanal seta 20μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 95B. Peritreme extends to anterior half of coxa II; peritrematal shield fused posteriorly with podal elements of coxae IV.

Chaetotaxy of legs shows deviations from the normal on most segments, the protonymphal patterns being retained on femur III and tibiae II–IV:

	I	II	III	IV
femur	$2-\frac{5}{3/4}-2$	$2-\frac{5}{3}-1$	$1-\frac{3}{1}-0$	$1-\frac{3}{1}-1$
genu	$2-\frac{3}{2}, \frac{2}{1}-2$	$2-\frac{2}{1}, \frac{2}{1}-2$	$2-\frac{2}{1}, \frac{2}{0}-2$	$2-\frac{2}{1}, \frac{2}{0}-1$
tibia	$2-\frac{2}{2}, \frac{2}{1}-2$	$1-\frac{1}{1}, \frac{2}{1}-1$	$1-\frac{1}{1}, \frac{2}{1}-1$	$1-\frac{1}{1}, \frac{2}{1}-1$

Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	114/66	96/60	84/54	108/54
tibia	108/60	90/57	84/52	102/48
tarsus	186/48	150/45	150/42	192/42

Male: Chelicera with segment I, 54μ ; II, 84μ ; fixed digit reduced, spermadactyl long (105μ), grooved, completely fused with movable digit (Text-fig. 96D). Four pairs of gnathosomal setae with *c.s.* about 50μ apart; *hyp.2* about 45μ apart; *hyp.1* normal. Other gnathosomal features as in female.

Dorsal shield ($636 \mu \times 276 \mu$) relatively broader than in the female, bearing 19 or 20 pairs of setae; three additional pairs (s_3 , r_3 and s_5) in the podonotal and one pair (J_5) in the opisthonotal region; in some specimens Z_1 is also on the shield.

Tritosternum with hyaline denticulate margin. Holovenral shield ($528 \mu \times 126 \mu$) with five pairs of setae in the sternito-genital region, two pairs in the ventral region and the usual three anal setae; sometimes one or more additional opisthogastric setae may be incorporated. Between st_1 , 63μ ; between st_1 and st_3 , 110μ ; paranal setae 27μ , postanal seta 18μ long. Peritreme extends to anterior margin of coxa II; peritrematal shield fused anteriorly with dorsal shield and posteriorly with podal elements of coxa IV. Unsclerotized cuticle of opisthogaster with six pairs of setae (Text-fig. 96A).

Chaetotaxy of legs as in female; seta pv_2 on tarsi III and IV modified to form a backwardly directed tooth-like projection (Text-fig. 96E). Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	87/54	72/48	66/45	81/45
tibia	90/50	70/45	72/42	87/42
tarsus	126/42	102/40	108/36	135/36

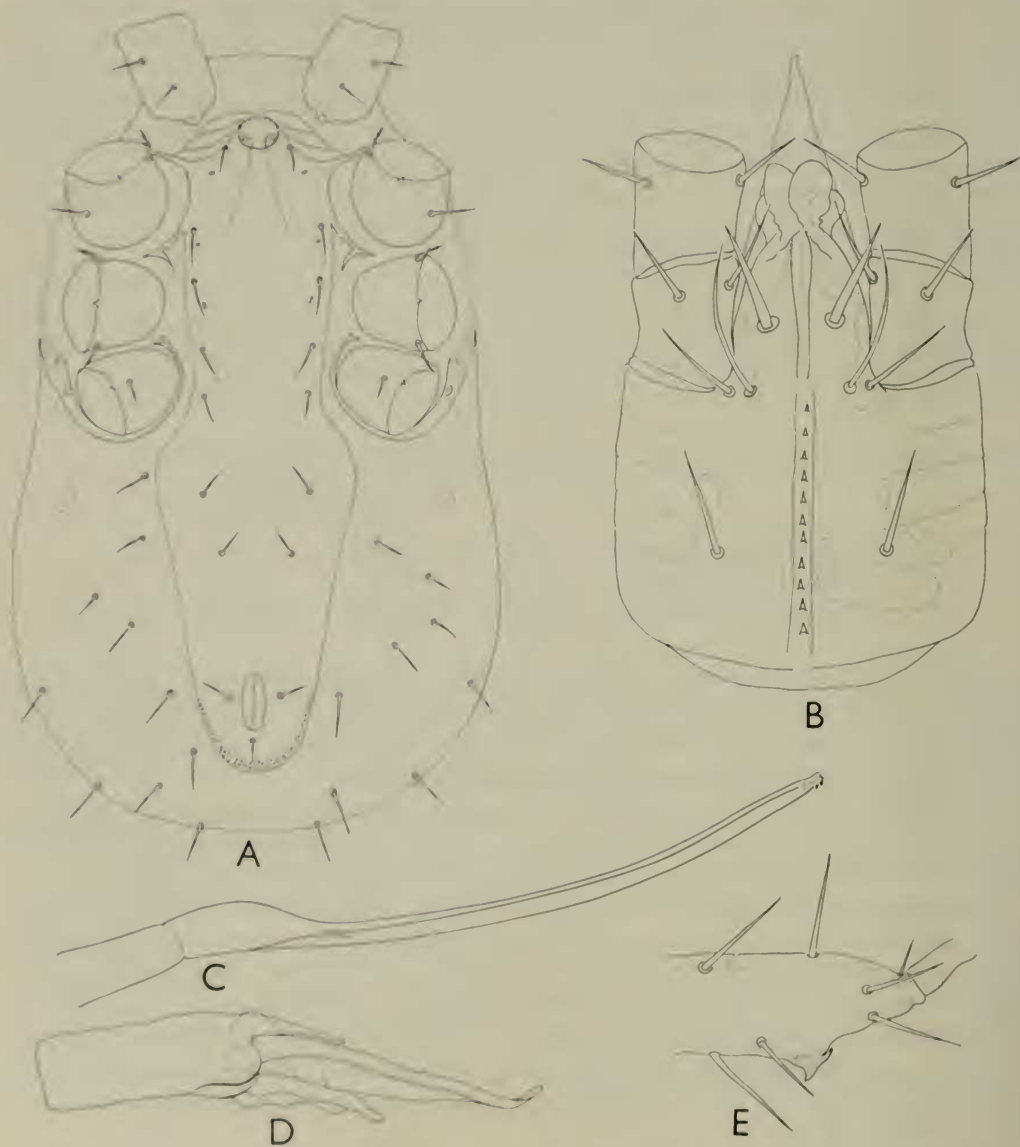


FIG. 96. *Dermanyssus gallinae* (De Geer). A. Venter of idiosoma of male; B. venter of gnathosoma of female; C. chelicera of female; D. chelicera of male; E. distal half of tarsus IV of male.

Protonymph: Gnathosoma, excluding pedipalps, essentially as in the female, but not so well developed. Four pairs of gnathosomal setae with *c.s.* about $36\ \mu$ apart, *hyp.2* about $33\ \mu$ apart. Pedipalps with normal chaetotaxy (1-4-5-12) for this instar.

Podonotal shield ($276\ \mu \times 120\ \mu$; maximum width $204\ \mu$) with a short posterior prolongation as in Text-fig. 97A; bearing nine pairs of setae. Opisthonotal region of dorsum with *J* series complete.

Tritosternum with base $45\ \mu$, laciniae $70\ \mu$. Sternal shield ($168\ \mu \times 108\ \mu$) with three pairs of setae and two pairs of pores. Between *st1*, $50\ \mu$; between *st1* and *st3*, $120\ \mu$. Genital setae absent. Anal shield ($66\ \mu \times 66\ \mu$; maximum width $75\ \mu$) with paranal setae $15\ \mu$, postanal seta about $6\ \mu$ long. Opisthogastric cuticle with six pairs of setae. Peritreme extends to middle of coxa III.

Chaetotaxy of legs normal for this instar except tibia IV which sometimes lacks the postero-lateral seta ($1-\frac{1}{1}$, $\frac{2}{1}-0/1$). Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	60/48	50/40	42/36	56/36
tibia	63/42	50/38	42/34	60/36
tarsus	114/36	96/30	96/30	130/30

HABITAT: *D. gallinae* is primarily an avian parasite of world-wide distribution which will attack mammals in the absence of its normal host. The hosts most commonly recorded are domestic fowl, turkey, duck, pigeon (*Columba livia* Gmelin), English sparrow [*Passer domesticus* (Linn.)], starling (*Sturnus vulgaris* Linn.) and canaries [*Serinus canarius* (Linn.)].

Dermanyssus chelidonis Oudemans

Dermanyssus hirundinis: Berlese, 1889, *Acar.*, *Myr. Scorp. ital.* fasc. 53, no. 3.

Dermanyssus chelidonis Oudemans, 1939, *Zool. Anz.* **126**: 306 (nom. nov. pro *D. hirundinis*

Berlese, 1889, non Hermann, 1804).

Dermanyssus chelidonis: Evans & Till, 1962, *Ann. Mag. nat. Hist.* (13) **5**: 283.

Female: Chelicera with segment I, $60\ \mu$; II, $420\ \mu$; digits minute (about $6\ \mu$), weakly dentate. Four pairs of gnathosomal setae with *c.s.* about $70\ \mu$ apart, *hyp.2* about $57\ \mu$ apart; *hyp.1* relatively stout. Deutosternum with 12 denticles in a single file. Corniculi membranous. Tectum capituli elongate, triangular, with smooth margin. Pedipalp (2-4-6-12) with two-tined apotele.

Dorsal shield ($816\ \mu \times 372\ \mu$) with 13 pairs of setae distributed as in Text-fig. 98A; setae *j1* and *J5* off the shield. Surface of shield patterned as in Text-fig. 98A.

Tritosternum with denticulate hyaline margin. Sternal shield ($45\ \mu \times 150\ \mu$) with two pairs of setae and two pairs of pores; *st3* and metasternals free on un-

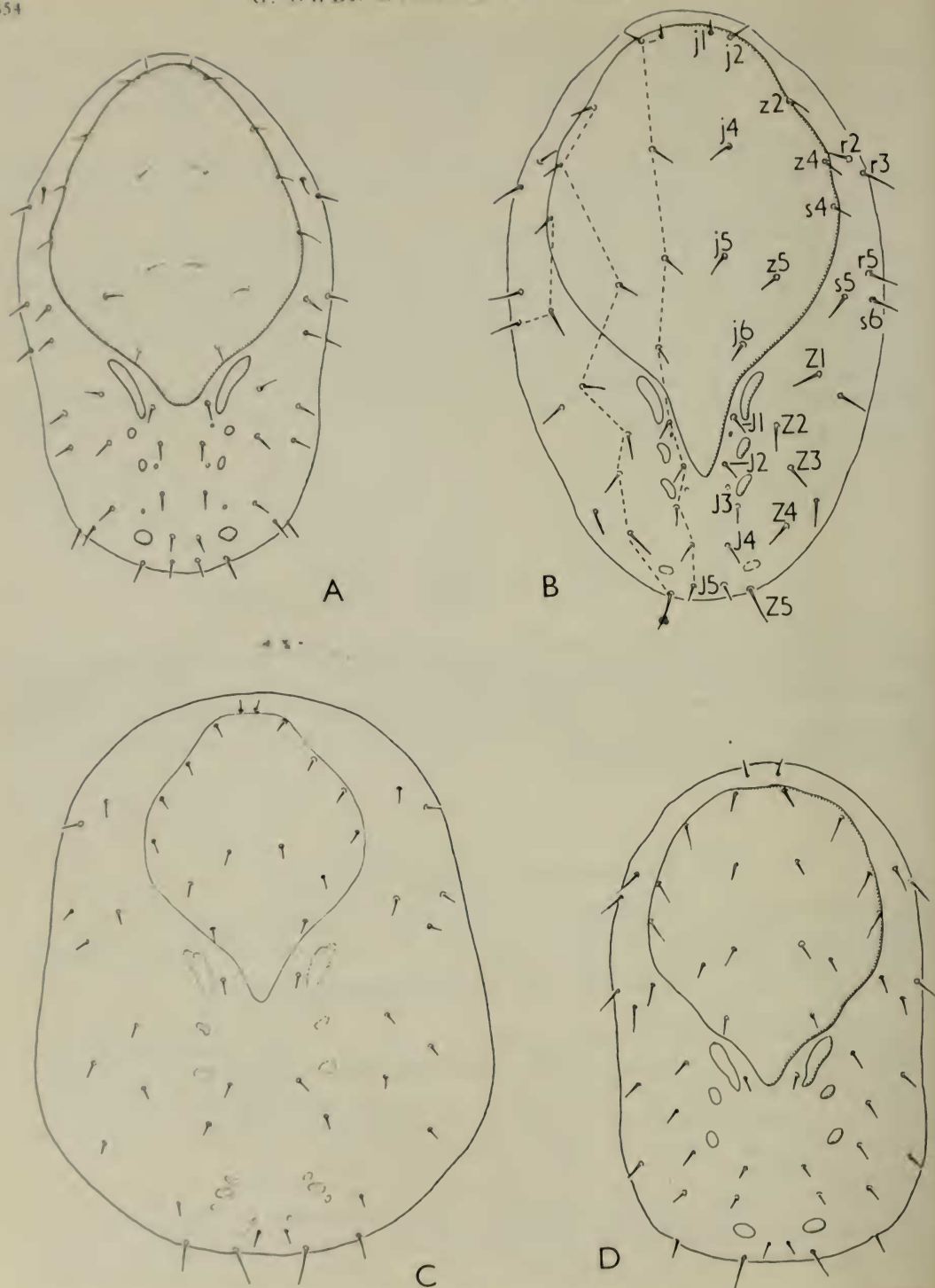


FIG. 97. Dorsum of idiosoma of protonymphs of four species of *Dermanyssus*; *D. gallinae* (A); *D. chelidonis* (B); *D. alaulae* (C); *D. hirundinis* (D).

sclerotized cuticle. Between $st1$, $100\ \mu$; between $st1$ and $st3$, $93\ \mu$. Genital shield ($222\ \mu \times 144\ \mu$) with genital setae only. Anal shield ($168\text{--}174\ \mu \times 150\ \mu$; maximum width $180\text{--}210\ \mu$) with paranal setae $40\ \mu$, postanal seta $27\ \mu$. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 98B. Peritreme extends to anterior half of coxa III; peritrematal shield short and free anteriorly, posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs with deviations from the normal pattern affecting most segments, with retention of the protonymphal pattern on femur III and tibiae II–IV:

	I	II	III	IV
femur	$2-\frac{5}{3}-2$	$2-\frac{5}{3}-1$	$1-\frac{3}{1}-0$	$0-\frac{3}{2}-1$
genu	$2-\frac{3}{2}, \frac{2}{1}-2$	$2-\frac{2}{1}, \frac{2}{1}-2$	$2-\frac{2}{1}, \frac{2}{0}-2$	$2-\frac{2}{1}, \frac{2}{0}-2$
tibia	$2-\frac{2}{2}, \frac{2}{1}-2$	$1-\frac{1}{1}, \frac{2}{1}-1$	$1-\frac{1}{1}, \frac{2}{1}-1$	$1-\frac{1}{1}, \frac{2}{1}-1$

Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	120/66	108/60	114/54	135/54
tibia	120/60	102/60	108/54	132/48
tarsus	198/54	162/48	174/45	222/48

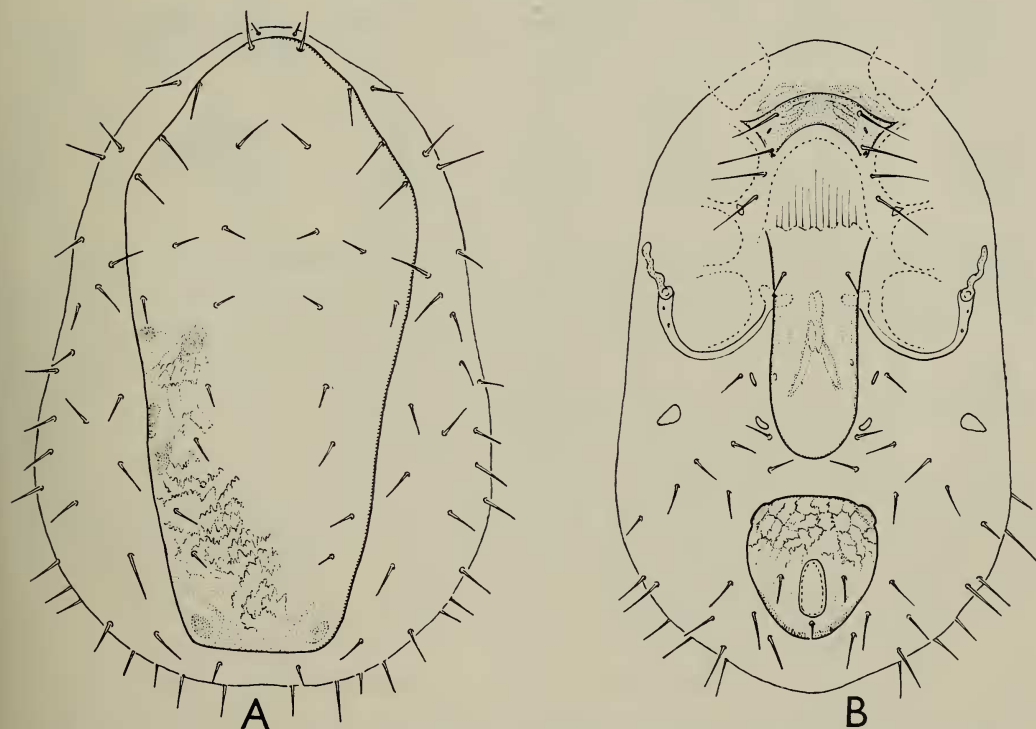


FIG. 98. *Dermanyssus chelidonis* Oudemans, female; dorsum (A) and venter (B) of idiosoma.

Protonymph : Dorsal shield markedly attenuated posteriorly, extending to a point behind the level of setae *J*2 (Text-fig. 97B) ; bearing nine pairs of setae, *j*1 being on the shield. Opisthonotal region of dorsum with *J* series of setae complete.

HABITAT : In the nests of swallows (*Hirundo rustica* Linn.) in England and Italy.

***Dermanyssus hirundinis* (Hermann)**

Acarus hirundinis Hermann, 1804, *Mémoire Aptérologique Strasbourg* : 83.

Dermanyssus hirundinis: Evans & Till, 1962, *Ann. Mag. nat. Hist.* (13) 5 : 285.

Female : Chelicera with second segment greatly elongated, digits minute, weakly dentate. Four pairs of gnathosomal setae with *c.s.* about $57\ \mu$ apart, *hyp.2* about $42\ \mu$ apart, *hyp.1* relatively stout. Deutosternum with ten denticles arranged in single file ; corniculi membranous with sclerotized bars. Tectum capituli elongate, triangular, with smooth margin. Pedipalp (2-4-6-12) with two-tined apotele.

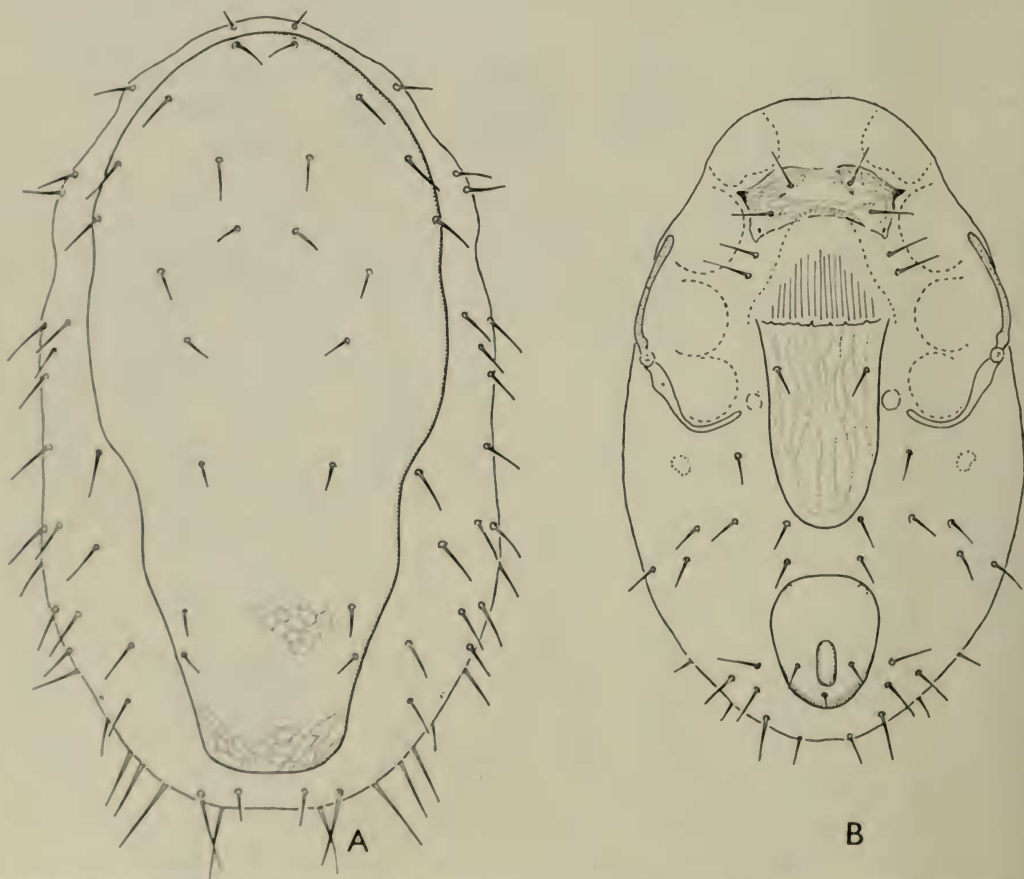


FIG. 99. *Dermanyssus hirundinis* (Hermann), female ; dorsum (A) and venter (B) of idiosoma.

Dorsal shield ($680\ \mu \times 294\ \mu$) with 11 pairs of setae distributed as in Text-fig. 99A; setae $j1$ and $J5$ off the shield, seta $J2$ missing. Surface of shield reticulated.

Tritosternum with base $60\ \mu$, laciniae $84\ \mu$, with hyaline denticulate margin. Sternal shield ($42\ \mu \times 130\ \mu$) weakly reticulated, with two pairs of setae and two pairs of pores; $st3$ and metasternals free on unsclerotized integument. Between $st1$, $63\ \mu$; between $st1$ and $st3$, $84\ \mu$. Genital shield ($180\ \mu \times 110\ \mu$) weakly reticulated, with genital setae only. Anal shield ($130\ \mu \times 105\ \mu$; maximum width $132\ \mu$) with paranal setae $33\ \mu$, postanal seta $18\ \mu$ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 99B. Peritreme extends to posterior third of coxa II; anterior part of peritrematal shield not developed, posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs shows deviations affecting most segments, with some intra-specific variability; protonymphal patterns retained on femur III and on tibiae II-IV:

	I	II	III	IV
femur	$2-\frac{5}{3}-2$	$2-\frac{5}{3}-1$	$1-\frac{3}{1}-0$	$0-\frac{3}{2}-1$
genu	$2-\frac{2}{2}, \frac{2}{1}-2$	$1/2-\frac{1/2}{1}, \frac{1/2}{1/0}-1$	$1-\frac{2}{1}, \frac{2}{0}-1$	$1-\frac{2}{1}, \frac{2}{0}-1$
tibia	$2-\frac{2}{2}, \frac{2}{1}-2$	$1-\frac{1}{1}, \frac{2}{1}-1$	$1-\frac{1}{1}, \frac{2}{1}-1$	$1-\frac{1}{1}, \frac{2}{1}-1$

Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	90/48	75/45	60/42	80/40
tibia	90/45	72/45	66/40	90/38
tarsus	165/40	126/40	126/40	162/36

Male: Chelicera with segment I, $50\ \mu$; II, $90\ \mu$; fixed digit reduced, spermadactyl long ($110\ \mu$), grooved, completely fused with movable digit. Four pairs of gnathosomal setae with *c.s.* about $50\ \mu$ apart, *hyp.2* about $50\ \mu$ apart, *hyp.1* normal. Other gnathosomal features as in female.

Dorsal shield ($570\ \mu \times 282\ \mu$) bearing 18 or 19 pairs of setae. In the podonotal region setae $j1$, $s1$, $s3$, $r3$ and $s5$ are on the shield; in the opisthonotal region $Z1$, $J5$ and sometimes $Z4$ are on the shield. Surface of shield reticulated.

Tritosternum with base $42\ \mu$, laciniae $66\ \mu$, with hyaline denticulate border. Holovenal shield ($468\ \mu \times 108\ \mu$) reticulated, with five pairs of setae in the sternito-genital region, two pairs in the ventral region and the usual three anal setae. Between $st1$, $52\ \mu$; between $st1$ and $st3$, $108\ \mu$. Paranal setae $27\ \mu$, postanal seta $15\ \mu$ long. Peritreme extends to middle of coxa II; peritrematal shield fused posteriorly with podal elements of coxa IV.

Chaetotaxy of legs as in female; seta pv_2 on tarsi III and IV modified to form tooth-like structures. Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	75/42	60/45	60/42	78/45
tibia	75/40	51/42	60/42	78/42
tarsus	114/34	75/36	—	—

Protonymph: Gnathosomal structures, excluding pedipalps, essentially as in female, but not so well developed. Four pairs of gnathosomal setae with c.s. about $36\ \mu$ apart, *hyp.2* about $32\ \mu$ apart. Pedipalps with normal chaetotaxy (1-4-5-12) for this instar.

Podonotal shield ($312\ \mu \times 120\ \mu$; maximum width $198\ \mu$) with slender posterior prolongation of variable length (Text-fig. 97D), bearing eight pairs of setae, *j1* being off the shield. Opisthonotal region of dorsum with four pairs of *J* setae, *J2* being absent.

Tritosternum with base $36\ \mu$, laciniae $70\ \mu$. Sternal shield ($180\ \mu \times 102\ \mu$) with three pairs of setae and two pairs of pores. Between *st1*, $48\ \mu$; between *st1* and *st3*, $108\ \mu$. Genital setae absent. Anal shield ($84\ \mu \times 57\ \mu$; maximum width $75\ \mu$); paranal setae $24\ \mu$, postanal seta $16\ \mu$ long; Opisthogastric cuticle with six pairs of setae. Peritreme extends to middle of coxa III.

Chaetotaxy of legs normal for this instar. Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	51/39	45/38	42/34	51/34
tibia	54/36	45/36	42/34	51/34
tarsus	98/32	93/30	90/30	98/28

Deutonymph: Gnathosoma essentially as in female. Four pairs of gnathosomal setae with c.s. about $45\ \mu$ apart, *hyp.2* about $36\ \mu$ apart.

Dorsal shield ($522\ \mu \times 198\ \mu$) with chaetotaxy as in female.

Tritosternum with base $50\ \mu$, laciniae $70\ \mu$. Sternito-genital shield ($270\ \mu \times 108\ \mu$) with three pairs of sternal setae, one pair of metasternal and one pair of genital setae, the metasternals and genitals being relatively short and fine. Between *st1*, $60\ \mu$; between *st1* and *st3*, $110\ \mu$. Anal shield ($105\ \mu \times 80\ \mu$; maximum width $96\ \mu$) with paranal seta $24\ \mu$, postanal seta $12\ \mu$ long. Integument of opisthogaster with 10 pairs of setae. Peritreme extends to posterior margin of coxa II; peritrematal shields apparently not developed.

Chaetotaxy of legs as in female. Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	69/45	60/42	51/40	63/36
tibia	72/42	57/40	54/36	72/36
tarsus	135/36	98/34	96/33	114/32

HABITAT: Recorded in Britain from *Hirundo rustica* Linn.

Dermanyssus alaudae (Schränk)

Acarus alaudae Schränk, 1781, *Enum. Ins. Austriae* : 515.

Dermanyssus alaudae: Evans & Till, 1962, *Ann. Mag. nat. Hist.* (13) 5 : 279.

Acarus truncatus von Olfers, 1816, *De Vegetativis etc. Commentarius* 1 (5) : 71.

Female : Chelicera with segment II greatly elongated, digits minute. Four pairs of gnathosomal setae with c.s. about $36\ \mu$ apart, *hyp.2* about $36\ \mu$ apart ; *hyp.1* relatively stout. Deutosternum with denticles arranged in a single longitudinal file. Corniculi membranous with sclerotized bars. Tectum capituli elongate, triangular, with smooth margin. Pedipalp (2-4-5-7/8) with two-tined apotele.

Dorsal shield ($576\ \mu \times 300\ \mu$) with ten pairs of setae distributed as in Text-fig. 100A ; setae *j1* and *J5* lie off the shield ; setae *j3*, *j4* and *J2* are absent. Seta *s4* considerably longer than the setae of the hexagon (*j5*, *z5*, *j6*). A well defined pore is located on each side of the shield slightly posterior to seta *s4*. Surface of shield without a well defined pattern.

Tritosternum with base $30\ \mu$, laciniae $66\ \mu$; with hyaline denticulate margin. Sternal shield (approximately $24\ \mu \times 120\ \mu$) weakly sclerotized, usually with one pair of setae ; *st2* and *st3* free on unsclerotized integument, metasternals absent.

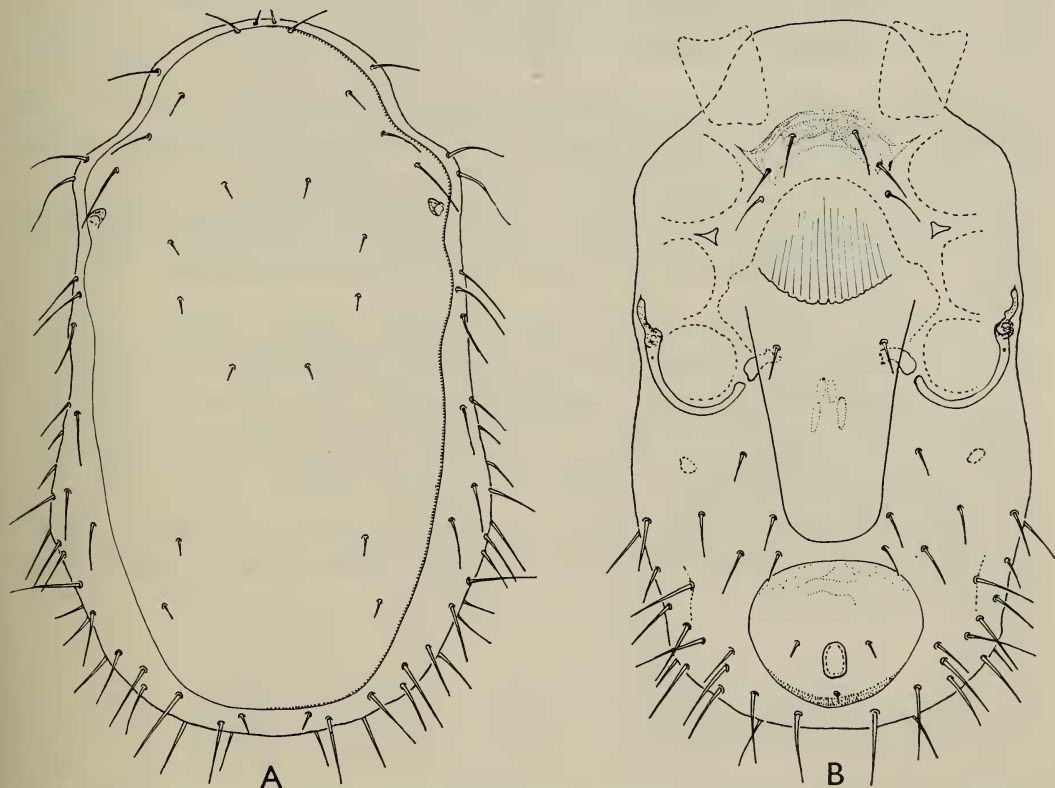


FIG. 100. *Dermanyssus alaudae* (Schränk), female ; dorsum (A) and venter (B) of idiosoma.

Between *st*1, 48 μ ; between *st*1 and *st*3, 57 μ . Genital shield (162 $\mu \times$ 120 μ) with no definite pattern and bearing genital setae only. Anal shield (108 $\mu \times$ 120 μ ; maximum width 135 μ) with paranal setae 20 μ , postanal seta 9 μ long. Chaetotaxy and sclerotization of opisthogaster as in Text-fig. 100B. Peritreme very short, extending to middle of coxa III; peritrematal shield not developed anteriorly, posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs shows deviations from the normal pattern on most segments, including trochanter I which lacks a dorsal seta (I— $\frac{0}{3}$ —I). Protonymphal patterns are retained on femora I and III, genua II and III and tibiae II–IV:

	I	II	III	IV
femur	2— $\frac{4}{2}$ —2	I— $\frac{4}{3}$ —I	I— $\frac{3}{1}$ —0	I— $\frac{3}{1}$ —0
genu	2— $\frac{2}{1}$, $\frac{2}{1}$ —2	I— $\frac{2}{0}$, $\frac{2}{0}$ —I	I— $\frac{2}{0}$, $\frac{2}{0}$ —I	I— $\frac{2}{1}$, $\frac{2}{0}$ —I
tibia	2— $\frac{2}{1}$, $\frac{2}{1}$ —2	I— $\frac{1}{1}$, $\frac{2}{1}$ —I	I— $\frac{1}{1}$, $\frac{2}{1}$ —I	I— $\frac{1}{1}$, $\frac{2}{1}$ —I

Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	57/50	60/48	50/48	60/45
tibia	54/48	54/48	50/45	60/45
tarsus	102/42	102/40	96/40	120/38

Protonymph: Gnathosoma, excluding pedipalps, as in female, but not so well developed. Four pairs of gnathosomal setae with *c.s.* about 27 μ apart, *hyp*.2 about 27 μ apart. Pedipalp (I–4–4/5–8) with minute, two-tined apotele.

Podonotal shield attenuated posteriorly to form a fairly acute point; with seven pairs of setae distributed as in Text-fig. 97C; *j*1 is off the shield and *j*3 and *j*4 are absent. Opisthonotal region with several small, ill-defined scutellae; setae *J*2 absent.

Tritosternum biramous; sternal shield sometimes with a weakly sclerotized posterior extension, with three pairs of setae and two pairs of pores. Between *st*1, 56 μ ; between *st*1 and *st*3, 102 μ . Genital setae absent. Anal shield (63 $\mu \times$ 72 μ ; maximum width 80 μ), paranal setae 15 μ , postanal seta 10 μ long. Opisthogastric cuticle with six pairs of setae. Stigma at level of middle of coxa IV, peritreme extending to anterior margin of coxa IV.

Chaetotaxy of legs normal for this instar except for femora II and III which have seven and five setae respectively. Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	33/42	33/33	24/36	30/36
tibia	30/40	30/36	27/33	30/33
tarsus	72/30	63/30	63/27	72/27

HABITAT: Recorded from *Alauda arvensis* Linn. in Scotland and Europe (Austria).

Dermanyssus quintus Vitzthum

Dermanyssus quintus Vitzthum, 1921, *Arch. Naturgesch.* (A) 86 : 7.

Evans & Till, 1962, *Ann. Mag. nat. Hist.* (13) 5 : 286.

Female: Chelicera with segment II greatly elongated, digits minute, weakly dentate. Four pairs of gnathosomal setae with *c.s.* about $42\ \mu$ apart, *hyp.2* about $36\ \mu$ apart; *hyp.1* relatively stout. Deutosternum with ten denticles arranged in a single longitudinal file. Corniculi membranous with sclerotized bars. Tectum capituli elongate, triangular, with smooth margin. Pedipalp (2-4-6-12) with two-tined apotele.

Dorsal shield ($672\ \mu \times 336\ \mu$) with 11 pairs of setae distributed as in Text-fig. 101A; setae *J5* off the shield, *J2* absent. Setae *j2*, *z2* and *z4* considerably longer than the remaining setae on the shield. Surface of shield weakly reticulate, with sculpturing anteriorly.

Tritosternum biramous, with hyaline denticulate margin. Sternal shield (approximately $40\ \mu \times 140\ \mu$) with a more strongly sclerotized central portion; bearing two pairs of setae and one pair of pores; *st3* and metasternals free on unsclerotized integument. Between *st1*, $72\ \mu$; between *st1* and *st3*, $90\ \mu$. Genital shield ($174\ \mu \times 60\ \mu$) with weakly defined linear markings and bearing genital setae only. Anal shield ($112\ \mu \times 138\ \mu$; maximum width $174\ \mu$) with paranal setae about $27\ \mu$ long. Opistogastric cuticle bears a prominent arc of stout setae (Text-fig. 101B). Peri-

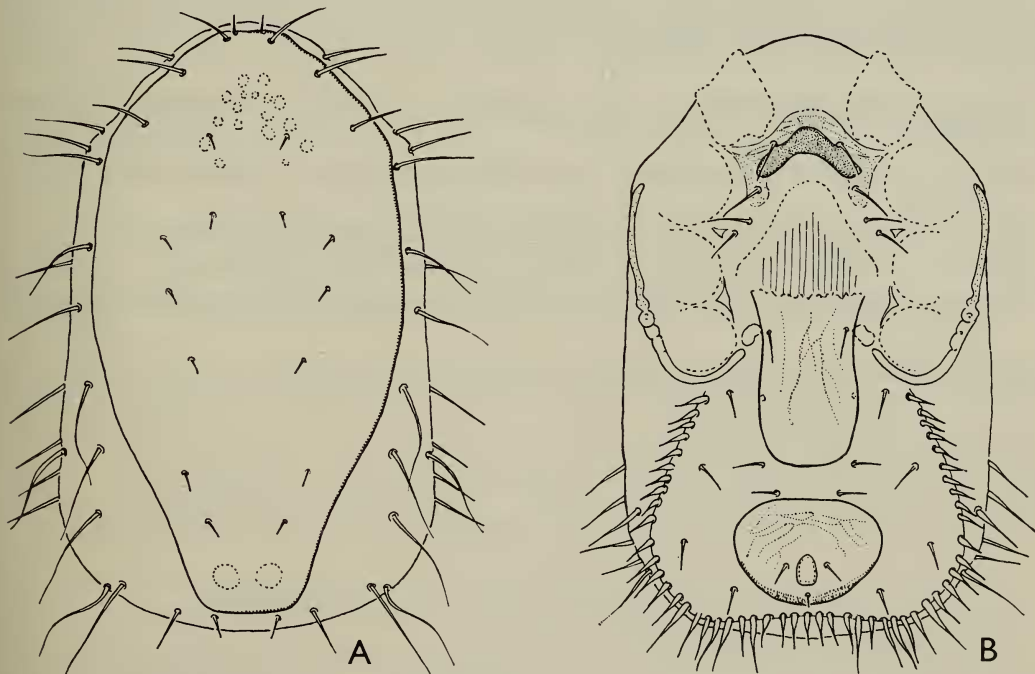


FIG. 101. *Dermanyssus quintus* Vitzthum, female; dorsum (A) and venter (B) of idiosoma.

treme extends to middle of coxa II; peritrematal shield not developed anteriorly, posterior part fused with podal elements of coxa IV.

Chaetotaxy of legs shows deviations from the normal on most segments, with retention of the protonymphal patterns on tibiae II-IV:

	I	II	III	IV
femur	$2-\frac{5}{3}-2$	$1-\frac{5}{3}-1$	$1-\frac{3}{1}-1$	$1-\frac{3}{1}-1$
genu	$2-\frac{3}{1}, \frac{2}{1}-1$	$2-\frac{2}{1}, \frac{2}{1}-1$	$1-\frac{2}{1}, \frac{2}{0}-1$	$1-\frac{2}{1}, \frac{2}{0}-1$
tibia	$2-\frac{2}{1}, \frac{2}{1}-1$	$1-\frac{1}{1}, \frac{2}{1}-1$	$1-\frac{1}{1}, \frac{2}{1}-1$	$1-\frac{1}{1}, \frac{2}{1}-1$

Coxa II without anterior spine. Length/width (in μ) of leg segments:

	I	II	III	IV
genu	78/60	78/66	69/60	75/57
tibia	78/57	75/63	66/57	72/54
tarsus	128/51	126/52	120/50	138/48

HABITAT: Recorded from *Dendrocopos major* (Linn.) in Britain, and from *Dendrocopos leucotos* (Bechstein) and *D. major* in Germany and the U.S.S.R.

SPECIES INCERTAE SEDIS

We have been unable to examine the type material of the following species of Dermanyssidae recorded from Britain and Eire. The original descriptions are inadequate for their certain identity.

Eulaelaps affinis Hull, 1925 (♂ and ♀), possibly a synonym of *Eulaelaps stabularis* (Koch).

Eulaelaps lapidarius Hull, 1925 (♀), possibly a synonym of *Pseudolaelaps doderoi* Berlese.

Hypoaspis fucorum Hull, 1925 (♂), referable to *Hypoaspis* (*Pneumolaelaps*).

Hypoaspis latifrons Hull, 1925 (♀), referable to *Hypoaspis* (*Gaeolaelaps*).

Hypoaspis nitidissimus Hull, 1918 (♀), possibly a synonym of *Haemogamasus pontiger* (Berlese).

Hypoaspis soricinus Hull, 1925 (♂).

Laelaps (*Hypoaspis*) *longipes* Halbert, 1915 (♂), possibly a synonym of *Haemogamasus horridus* Michael.

Laelaps (*Hypoaspis*) *ovatus* Halbert, 1915 (♀), referable to *Pseudoparasitus*.

Laelaphis birksianus Hull, 1925 (♀), referable to *Hypoaspis* (*Gymnolaelaps*).

Laelaphis fuscipes Hull, 1925 (♂ and ♀), referable to *Hypoaspis* (*Gymnolaelaps*).

SUMMARY OF NEW TAXA AND SYNONYMY

1. The following new taxa are proposed:

subfamilies: Hirstionyssinae nov., Melittiphinae nov. and Pseudolaelapinae nov.

genus : *Domronyssus* nov., type : *Pneumonyssus dentatus* Domrow, 1961 (Laelapinae)

species and subspecies : *Hirstionyssus oryctolagi* nov., *Hypoaspis breviseta* nov., *Hypoaspis colomboi* nov., *Hypoaspis giffordi* nov., *Hypoaspis hyatti* nov., *Hypoaspis neocuneifer* nov., *Hypoaspis nidicorva* nov., *Hypoaspis casalis myrmecophila* nov.

2. The following new synonymy is presented :

- Allonyssus* Buitendijk, 1945, a synonym of *Macronyssus* Kolenati
Austrogamasellus Domrow, 1957, a synonym of *Pseudoparasitus* Oudemans
Daviseilla Zumpt & Patterson, 1951, a synonym of *Stratiolaelaps* Berlese
Groschaftella Samsinak, 1957, a synonym of *Haemogamasus* Berlese
Sauronyssus Sambon, 1928, a synonym of *Ophionyssus* Mégnin
Cosmolaelaps gurabensis Fox, 1946, a synonym of *Hypoaspis miles* (Berlese)
Eulaelaps kolpakovae Bregetova, 1950, a synonym of *Eulaelaps novus* Vitzthum
Hypoaspis compressus Hull, 1925, a synonym of *Hypoaspis lubrica* Voigts & Oudemans
Hypoaspis nolli Karg, 1962, a synonym of *Hypoaspis praesternalis* Willmann
Hypoaspis soarianus Hull, 1925, a synonym of *Androlaelaps casalis casalis* (Berlese)
Ichoronyssus orcadensis Turk, 1946, a synonym of *Hirstionyssus latiscutatus* (de Meillon & Lavoipierre)
Laelaspis ovatus Willmann, 1951, a synonym of *Hypoaspis astronomica* (Koch)
Laelaps pachypus: Oudemans, 1927 (male), a synonym of *Hyperlaelaps microti* (Ewing)
Laelaps pachypus: Oudemans, 1927 (female) a synonym of *Hyperlaelaps amphibia* Zachvatkin
Laelaps (*Hyperlaelaps*) *arvalis* Zachvatkin, 1948, a synonym of *Hyperlaelaps microti* (Ewing)
Pseudoparasitus angulatus Berlese, 1917 a synonym of *Laelaps* (*Hypoaspis*) *oblonga* Halbert, 1915.
Liponyssus rhinolophi Oudemans, 1902, a synonym of *Macronyssus uncinatus* (Canestrini)
Ololaelaps halaskovae Bregetova & Koroleva, 1964, a synonym of *Ololaelaps veneta* (Berlese).

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ABBREVIATIONS USED IN TEXT AND FIGURES

<i>ad</i> ₁₋₃	antero-dorsal setae	<i>Jv</i> ₁₋₅	internal ventral setae
<i>al</i> ₁₋₃	antero-lateral setae	<i>lat.l.f.</i>	lateral lyriform fissure
<i>av</i> ₁₋₃	antero-ventral setae	<i>m.d.</i>	movable digit
<i>c.s.</i>	capitular setae	<i>p</i> ₁₋₃	sternal pores
<i>d</i> ₁₋₃	dorsal setae	<i>p.d.</i>	pilus dentilis
<i>d.l.f.</i>	dorsal lyriform fissure	<i>pd</i> ₁₋₃	postero-dorsal setae
<i>d.s.</i>	dorsal seta	<i>pl</i> ₁₋₃	postero-lateral setae
<i>f.d.</i>	fixed digit	<i>pv</i> ₁₋₂	postero-ventral setae
<i>gen.</i>	genital setae	<i>px</i> ₁₋₃	posterior accessory setae
<i>hyp</i> ₁₋₃	hypostomal setae	<i>r</i> ₂₋₆	marginal series of podonotal setae
<i>ji</i> ₁₋₆	dorsal series of podonotal setae	<i>R</i> ₁₋₇	marginal series of opisthotal setae
<i>J</i> ₁₋₅	dorsal series of opisthotal setae		

<i>sl</i> -6	lateral series of podonotal setae	<i>v</i> ₁₋₂	ventral setae
<i>St</i> -5	lateral series of opisthonotal setae	<i>st</i> -6	median series of podonotal setae
<i>sp.</i>	spermadactyl	<i>Z</i> ₁₋₅	median series of opisthonotal setae
<i>st</i> ₁₋₃	sternal setae	<i>Zv</i> ₁₋₅	medio-lateral ventral setae
<i>st</i> ₄	metasternal setae		
<i>UR</i>	submarginal series of opisthonotal setae		

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